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AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XXXVIII NEW YORK—THURSDAY, FEBRUARY 28, 1918—CHICAGO NO. 9

New Methods of Chassis Lubrication

Designs for Minimizing Attention and Increasing Life of Parts—Advantages and Disadvantages of Oil and Grease Lubrication—Oil-less Bushings—Direct Feed and Wick Feed Systems

By Cornelius T. Myers

WHEN we speak of chassis lubrication we refer to the lubrication of such minor parts of an automobile as spring bolts, brake connections, universal joints, radius rod connections, steering rod joints, etc., which form connecting links between the more important units of the chassis. Lack of proper lubrication at these points is not immediately evident in the performance of a motor vehicle, whereas lack of lubrication in the engine, gearbox or axles makes itself felt in a very short time; hence, comparatively little attention has been paid to the lubrication of chassis parts and their durability and efficiency have suffered.

These parts also are in more or less inaccessible locations, as a rule, and the importance of their proper lubrication has been lost sight of. Rightly, the lubrication of these parts should have been more carefully considered, in the light of the important function performed by them, and especially on account of their comparative inaccessibility. Wear at these points is almost always due to improper or insufficient lubrication, and this wear is responsible for squeaks, rattles, emphasized vibration, and break-down to an extent only appreciated by an experienced garageman. The summation of small amounts of wear in many parts accounts for many chassis troubles, quite a few of which have been wrongly interpreted in the past. Major parts of the complete machine have been called upon to work under improper conditions and their design often has been adversely affected by these conditions.

Important Units Receive Attention

In gearboxes we have an instance of careful thought for lubrication in an inaccessible position. The details have been carefully worked out so that, under ordinary conditions, one filling with moderately heavy oil per year will suffice for satisfactory service. The same comment applies to rear axles, so far as the lubrication of parts in the housing is concerned. The general plan in these two instances is that of retention of lubricant and exclusion of dirt, to which method the design and operation of these parts lend themselves.

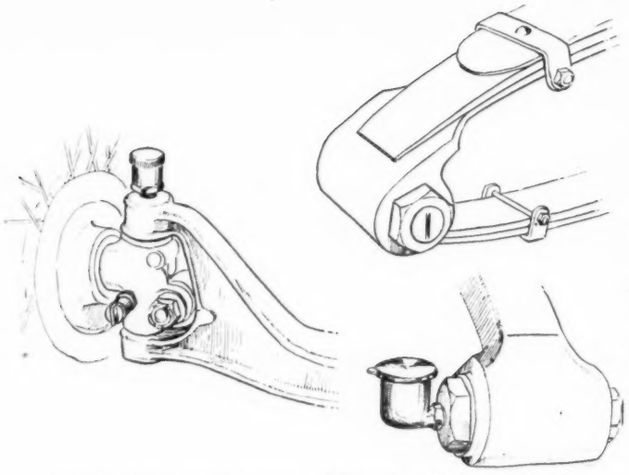
The lubrication of engines has been given careful and constant attention until very reliable systems have been developed. These systems are all based upon a continuous wastage of lubricant and the partial exclusion—partial removal—of foreign matter. It is upon this principle that the lubrication of most chassis parts must be handled, involving more or less continuous flow of lubricant. The more continuous this flow when the vehicle is being operated, the more efficiently will the bearing surfaces be lubricated, other things being equal. This being the case, care must be exercised to see that dirt or other non-lubricating matter is not picked up and led to the bearing surfaces.

Choice of Lubricant for Chassis Parts

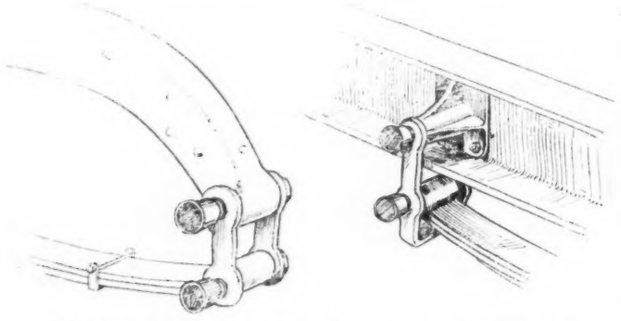
The most important consideration in the design of the chassis lubrication devices is the choice of lubricant. Shall grease or oil be used? Each has advantages and drawbacks.

Grease is stiff enough, as a rule, to be more cleanly than oil and not flow over painted surfaces near the grease cups. It lends itself to compact and simple design of cups integral with spring bolts, and its firmness allows grease cups to be set at an angle or even in an inverted position, which is often very convenient where holes for the cups must be tapped in restricted locations. Some claim that grease will support heavier bearing loads, but the difference is probably more apparent than real. Grease can be forced by hand screws from the cups to the various surfaces. In hot weather the heavier greases are possibly more cleanly to handle than oil with the ordinary chassis fittings.

On the other hand, grease must stand under heavy in-



Upper right-hand corner—Oil spring bolts on Franklin car, filled with waste. Below—Oil cups on steering knuckle and spring bolts of Premier



Oil cups with spring-retained caps on spring bolts of new Nash car

dictments. It is a splendid dirt carrier, and the methods of handling it expose it to dirt at every turn. We are all familiar with the open grease pail in garages, and with the dirty grease paddle which is scraped over the edge of the pail. We all know of dirty fingers lending their share to the contents of the refilled grease cup, which often catches no small portion of the dirt accumulated on the outside edges of the cup or its stud.

Another important consideration in the use of grease is that most greases are full of inert matter, which makes them more or less stiff and heavy, but which has a negative qualification as a lubricant. The heavy body of most greases is commonly thought to give them greater capacity for maintaining a lubricating film between the wearing surfaces, but this is not so, for in almost every case the stiffer the grease the poorer its lubricating value and its load-sustaining qualities, the inert filler acting as much in the nature of an abrasive as a lubricant.

Grease does not readily spread itself in a film over the wearing surfaces, especially if it is applied when they are loaded or when cold. This offsets the apparent advantage of being able to force grease out of the cups, for it often juts out at the opposite end of a bearing without actually spreading over that bearing, the appearance of the grease being a misleading sign that the bearing is properly lubricated. If all parts of a bearinng are not lubricated the dry parts will soon accumulate dirt or inert matter and start a cutting action.

When very cold it is almost impossible to force grease through small drilled holes and channels. It is therefore difficult to know when a grease-filled bearing is even getting the lubrication designed for it.

Grease on painted surfaces is hard to remove in washing a car.

Oil the Best Lubricant

Oil, as a lubricant, has great advantages over grease, but it is not always as cleanly and its proper application to chassis bearings has required more painstaking design than has usually been given to it. These things have militated against its use, especially on passenger cars, but the advantages that follow are appealing more and more to designers and to users.

Oil will maintain as heavy a bearing load as grease, and with less friction.

Oil fed to one properly located point in a bearing will soon spread over the entire bearing surface.

Oil will flow through a very small hole, and it can be conducted a considerable distance by means of capillary attraction and surface tension.

Oil will carry much less dirt than grease, and it is not nearly so much exposed to dirt when in bulk or when being applied.

Oil contains no inert matter to clog holes and channels.

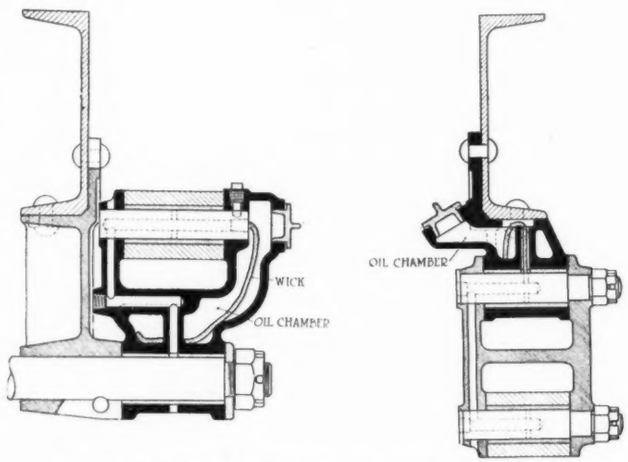
The oil used in the engine can be used in the chassis oilers, eliminating the necessity for carrying two kinds of lubricant.

Oil is more easily applied than grease.

A flow of clean oil tends to clear a bearing of any dirt which it may contain, and a bearing arranged for oil lubrication can be flushed and cleaned with gasoline or kerosene.

Oil for Chassis Lubrication

Up to a few years ago grease was almost universally used for chassis lubrication. In 1912 the writer had oil cups installed on some of the GMC trucks, and in 1913 designed and built an experimental truck on which oil was used at almost every point. This truck is still operating on the original pins and bushings, which show only a trace of wear. More recently we have seen a slow but steady increase in the use of oil, which seems now to have gained a very fair headway on both trucks and passenger cars. The severe service to which motor trucks have been put has proven the advantages of oil over grease, and it is in truck design that the greatest progress has been made in the use of oil. The court of last resort on the reliability, and hence the desirability of almost all features of chassis design, is the repair shop—our service stations and garages. It is here in particular that lubrication failures are noticed and the most reliable



Magazine wick feed shackle and shackle bracket as used on Fageol truck

evidence secured. The most notable instance of passenger car chassis lubrication with oil was the outcome of extensive garage experience.

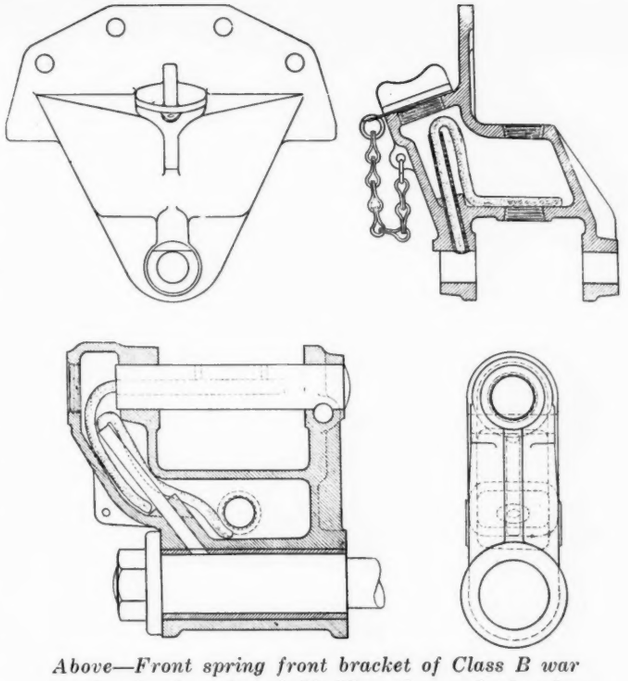
In the past 3 years so-called oil-less bushings of various composition have come into considerable use for spring bolts, pedal shafts, brake shafts, etc. Some are made of hardwood impregnated with lubricant, some of brass or bronze with inserts of graphite or other lubricant, some of a lubricant impregnated woven material, resembling brake lining, fitted inside a steel shell which holds it in shape. When properly selected and applied they have in most instances been quite serviceable, and showed a notable improvement at points which have heretofore not had much, if any, lubrication, because they have been difficult to reach.

The writer considers these bushings in the light of a palliative and not a solution of the problem of lubricating such points, because they contain a very limited amount of lubricant which must suffice for the life of the bushing. These oil-less bushings are well adapted to eyes in levers and rods which usually get no lubrication at all, such as the eyes in clutch throw-out levers, brake levers, etc. A better way of lubricating these points, however, is to arrange that the drip or seepage from other bearings is led to them.

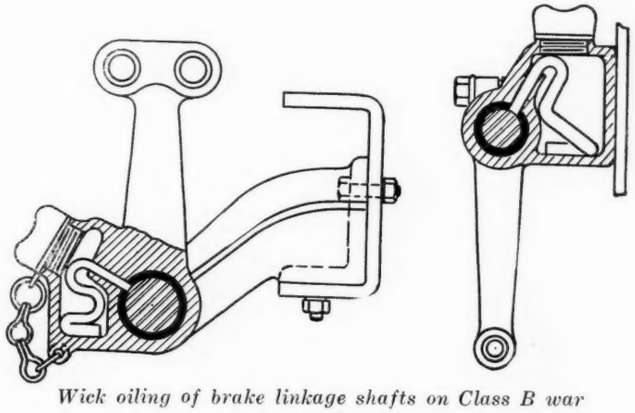
That oil lubrication of many chassis parts has been adopted by quite a number of well-known builders shows that experience is being heeded, and attempts to improve reliability are being made. As *reliability* is the large word in all automotive design we can expect further improvement in details for the use of oil.

This brings us to the consideration of the methods to be used in handling oil as a chassis lubricant. There are two general methods: 1—Direct feed. 2—Wick feed.

1—The direct feed method can be divided into two systems: *a*—The individual point; *b*—The central supply.



Above—Front spring front bracket of Class B war truck, showing chain-held filler plug and pipe for wick. Below—Rear spring rear shackle on Class B war truck, showing separate feeds for spring bolt and shackle bushing



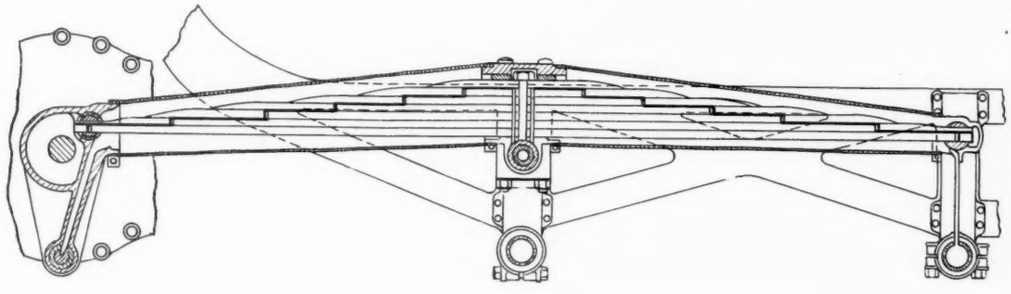
Wick oiling of brake linkage shafts on Class B war truck

Individual Feed System

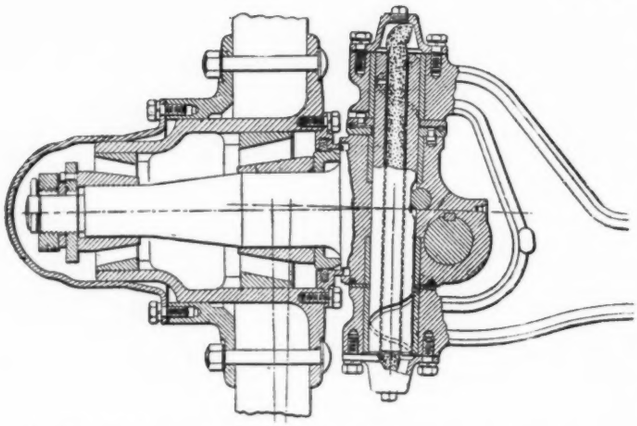
The individual point system consists of small oil cups applied in the place of grease cups, with the necessary modifications to insure gravity feed. This is crude and open to the objections that dirt can enter the bearing with the oil, that but a small amount of oil is carried at each point, and that the oil is quickly drawn from the cup. This means that frequent attention (almost daily) is necessary, oil is wasted, and it sometimes drips and makes the neighboring parts somewhat unsightly.

Various types of oil cups have been used to minimize the outflow of the oil they contain. Those most popular are small brass cups, ⅛ in. pipe tap size, with a snap lid, and which contain a thimbleful of wool or cotton waste held in by a wire screen. Any such cup, however, is objectionable because it can be, and often is, easily knocked off, leaving the shank jammed in the tapped hole. They are so small that the loss of one sometimes goes unnoticed for some time, and then replacement is delayed because the machine seems to run all right without it. In this system the brackets for pedal shafts, rocker shafts, etc., are simply drilled and countersunk to receive a drop or so of oil from a squirt can when the spirit moves the man in charge to be over-curious and discover them.

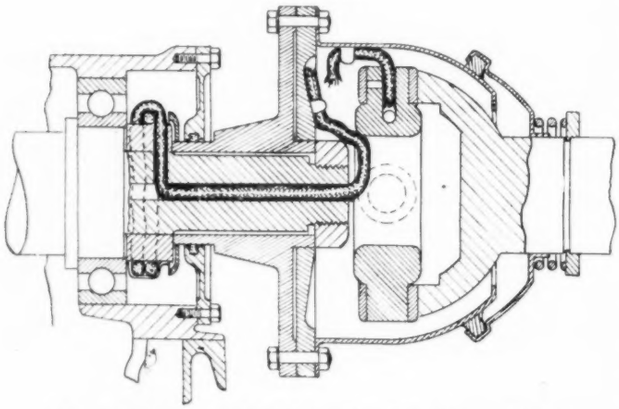
The only instance of the central supply system is that embodied in the Fergus car. In this chassis oil is led from the motor by pipes to four central supply points—the fulcrum pins of the cantilever springs—and from these



Fergus cantilever spring enclosed in a leather boot and provided with oil channels for a regular system of oil circulation



Wick lubrication of knuckle pin bearings on Class B war truck



Myers' system of wick lubrication for universal joints

is distributed to springs, spring bolts, steering and brake connections and levers. Only a few of these cars have been placed on the market, and the system has not been adapted to any other car, so far as the writer is aware. This is possibly due to the fact that it does not lend itself readily to our more or less standardized chassis design. The oil, being supplied by a pressure from the engine, is liable to a considerable loss due to leak or breakage, with consequent danger of exhausting the supply in the engine and the nuisance of a considerable flood of oil. The system, however, courts development.

Feeding Oil by Capillary Attraction

The wick feed method can also be divided into two systems at present, viz.—the individual point and the magazine feed, which latter is really a development of the former.

The individual point system was first used by the writer in 1913 (on the truck to which reference has been made) and consisted of small wick oilers applied in place of grease cups, certain of the chassis parts being designed to lend themselves to this kind of lubrication. The results obtained were so satisfactory that the writer became a firm advocate of oil for chassis lubrication. From 1914 to the present we have seen more and more use made of this system, which is quite effective. The wicks feed oil slowly but speedily when the machine is in motion, and the oil supply is conserved so as to last much longer than with the direct feed cups. The large number of points to be oiled, however, make it likely that some will be overlooked; and the small wick oilers are open to the same objections as the direct feed oilers—they get damaged or lost and are not often replaced promptly.

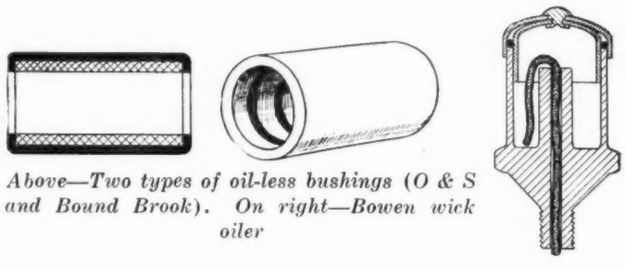
In 1915 the writer conceived the idea of improving the chassis lubrication by a magazine system using oil carried so as to require a minimum of attention, both as to the number of points and the number of fillings; which would feed clean oil as needed to the bearing surfaces; and which would not be liable to damage under careless handling. The first opportunity for carrying this out came in 1916, when it was incorporated in the design of the Fageol line of motor trucks.

Magazine System for Oiling Chassis Parts

The main feature of this magazine system was a series of hollow brackets and shackles for the spring bolts and rocker shafts. These brackets held oil which was wick fed to the various bearing surfaces by capillary attraction, there being no direct gravity feed. Felt wicks about ¼ in. in diameter, dipping to the bottom of the pockets, carried the oil to the top of the pockets and then through drilled passages to the bearing surfaces. In some cases after reaching the initial bearing the oil flowed to another nearby and then to the springs, which were kept from rusting and from stiffening. The rear spring shackles are hollow and contain oil fed by wicks to the spring bolts and to the shackle bar. The pins of the front shackle are fed in series from the bracket above. The knuckle pins and the steering connections on the front axle were designed to take large steel oil cups with wick feed. The cored brackets hold oil enough to last from 6 weeks to 2 months; the supply in the cups will last about half as long. The brackets are closed by large pipe plugs, the cups by swivel caps with registering holes near the wall of cups.

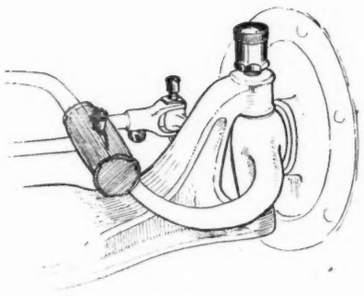
The scheme was further developed in the Class B war truck, where the brake levers and brackets, shackles and shackle brackets are cored and the oil is wick-fed to the bearing surfaces. The filling holes are closed with large wing plugs permanently attached by chains to prevent loss. The knuckle pins in the front axle are oil lubricated by wicks leading oil from wells at the bottom of the pins up through the pins themselves, and fed to the bushings and thrust washers.

The method of lubrication has many advantages. It requires almost no attention—once a week for the cups and once a month for the brackets at the most. There are but very few oil cups, they are not exposed to damage, and the cups are large (¼ in. or ⅜ in. pipe tap) and strong. They are well protected, as they are only used on steering connections, rear axle brake camshafts, steering gear, pedal shafts, etc., which points are not exposed to collision. Dirt cannot enter bearings with

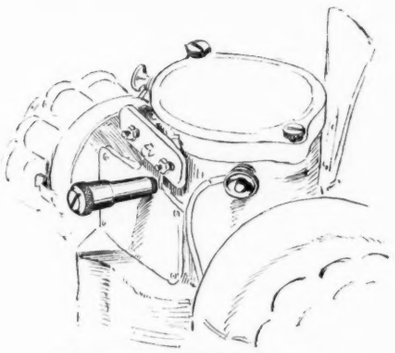


Above—Two types of oil-less bushings (O & S and Bound Brook). On right—Bowen wick oiler

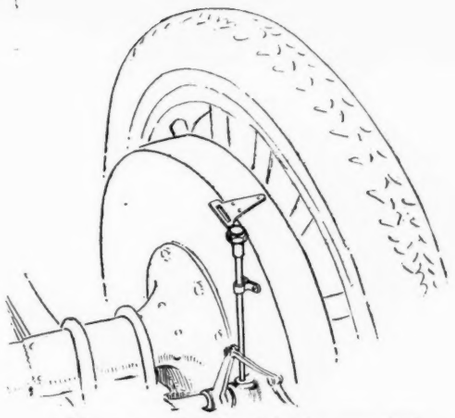
Winkley oilers used on Ford spring bolts and front axle



Oil cups on spring bolts and steering connections of Kissel car



Oil cup on Packard governor housing



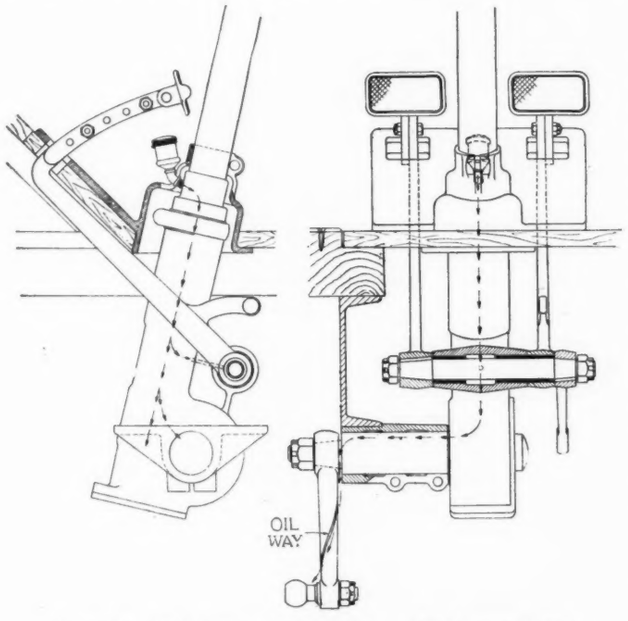
Oil cup on Packard brake camshaft raised to convenient height

the oil, even if the oil is dirty or if dirt enters the brackets and cups when being filled. Under the action of vibration and the movement of the lubricated surfaces the oil feeds slowly and regularly whenever the machine is in motion, but stops when the machine stops. This renders every bit of bearing surface continuously effective and prevents wear, squeaks, rattles and rust. The same oil used in the engine can be used in cups or brackets. This insures a good lubricant, and one which is light or heavy as the weather is cold or hot. So little oil is used that the expense is very small—less than grease when grease is applied as often and as carefully as it should be. The cups and pockets can be easily and quickly filled, and it is not a messy job; they can also be cleaned with gasoline and a squirt gun.

Control of the Feed

The main disadvantage is that at some points the oil is apt to feed more freely than necessary and coat the surrounding parts, unless care is taken to get wicks of the proper material and properly fit them in the holes. Rapid feed would be particularly objectionable from a passenger car standpoint, but care in design and fitting will obviate this. Cotton wicks and wicks loose in the drilled holes feed quite fast. Felt wicks, especially when snugly fitted, reduce the feed. If a very fast feed is desired a couple of fine wires, twisted and used as a wick, will give a surplus of oil at the expense of more frequent filling of the cup or pocket.

Where there is a great deal of vibration, as on axles, the rate of feed is accelerated. This is also the case where there is a great deal of motion between the lubricated surfaces, as is often the case with front spring bolts. The location of the final outlet hole to the bearing surfaces, too, has an influence on the feed, which is slower when this hole opens on the load side of the pin than when it opens on the free side.



A series feed from a wick oiler. Oil is supplied to the thrust bearing, the screw and nut, the trunnions and rocker shaft of the Ross steering gear, and the slight leakage is conveyed by a spiral channel on the steering arm to the ball joint. A branch feeds the pedal shaft bearings and the leakage goes down to the clutch release lever and oils its clevis

Feeding Oil by Wicks

Objection has been made to feeding oil by wicks in cold weather, on account of the increased viscosity of the oil. It is true that the flow will be reduced if some means is not taken to offset very severe weather; but the system lends itself remarkably well to this condition, as the oil can be thinned down with kerosene. If engine oil is used at the chassis points, lighter oils are commonly used in cold weather, anyway. The lubrication afforded by grease in very cold weather is almost negligible, because it is almost impossible to force the grease to the bearing surfaces.

In all trials of the magazine system that have come to the writer's notice, its reliability, efficiency and durability have been well proven. The upkeep cost is practically nil. Operating cost and attention are reduced to a minimum. The first cost of brackets is somewhat greater, but there is a saving on fittings, so that the net cost is a little more than the old grease cup system of lubrication. For trucks the increased cost is not important, compared with the advantages secured. This should also hold for passenger cars, but up to the present the writer knows of no applications in this field. The improvement and modification of the details of design will obviate objections to this system as a production proposition, for it tends toward simplicity and not complication, and it is susceptible of considerable development as to detail.

The magazine system is applicable to the front axle, spring bolts and shackles, steering gear, starting crank, fan, pedal details, etc., and it lends itself to what might be called series lubrication—the seepage or surplus oil from one bearing being led to another and thence to a

third or even fourth; as in a steering gear, oil can be successively used on the thrust collar, the actuating mechanism and the trunnion bearing, and then led out and down the steering arm to the ball joint on the drag link.

The lubrication of universal joints has always been an unsatisfactory proposition. Oil is the best lubricant, but great difficulty has been encountered in retaining oil in the casing of the joint for more than a short time. Hard grease is easily retained, but is a poor lubricant at these points, especially in cold weather. A medium grease is most used, but it is far inferior to oil for the same reasons as were given for other chassis parts. One of the illustrations herewith shows a method devised by the writer for magazine lubricating a universal joint by drawing small amounts of oil intermittently from the gearbox, clutch case or rear axle. If the oil ultimately escapes, as it will in the ordinary joint, it will be in very small amounts and will make little difference. It can be so arranged that a part of the escaping oil will lubricate the slip joint. This is very important, especially with machines that use the Hotchkiss drive, where there is a considerable movement at the slip joints. Unless this point is well lubricated, a serious end thrust will be put upon the universal joint and on the bearings behind it in the gearbox.

Advisability of Spring Lubrication

There is some difference of opinion as to the advisability of lubricating a spring. The magazine system leads the surplus oil from the spring bolts to the spring leaves. This prevents rust and eliminates squeak. It maintains the flexibility of the spring at approximately that given it by the spring maker, depending upon the amount of oil led to the spring, its distribution between the plates, and the manner in which the plates are formed and fitted. When the flow of oil to the spring bolts is properly regulated, there is not sufficient oil led to the leaves of the spring bolts to destroy its interleaf friction, for the high spots between the leaves break through the oil film and there is metal to metal contact—but without squeak and without accumulation of rust.

Labor Shortage Calls for Automaticity

To-day in every line we need devices that require the minimum of attention and serve their purpose with the greatest reliability. The passenger car and motor truck of the immediate future must offer these advantages, for they will be called upon to serve more constantly and there is surely going to be a shortage of chauffeurs and garage help. Women now drive their cars and should be able to care for them, when necessary, with but little assistance. Women will be called upon more and more to handle delivery cars and light trucks, relieving the shortage of men as they are called in greater and greater numbers to our armies. The men left in the garages will have less time to pay attention to detail, for they will have to look after more machines. The little troubles that so often cause annoyance and breakdown are largely due to lack of lubrication, and as a fighting nation we cannot afford them. By the provision of lubricating devices as described they can be avoided.

Strenuous Tests of the Class B War Truck

WHEN the first samples of the Class B truck were completed they were subjected to the severest kinds of tests to bring to light any possible weaknesses. Roads and trails resembling as closely as possible the shell-torn highways behind the front in France were selected. Some of the tests are illustrated herewith

Opposition to Standardized Trucks

Disagreement Among Manufacturers Interested—Effort to Sidetrack Standardized Models—Arguments Advanced by Both Sides

WASHINGTON, Feb. 27—It is not surprising that the national significance of standardization of war apparatus such as trucks, aviation engines and tractors should not be duly appreciated by the entire industries producing such apparatus when it is remembered that many of these great industries have since their inception been engrossed with necessary expansion to meet imperative demands from waiting buyers.

War has injected new imperative factors into standardization as a needed war weapon, and it will be some time before the national and international significance of war standardization and great post-war standardization is appreciated.

The economic fundamentals underlying such are not as fully appreciated as they will be 12 months hence.

Significance of Shipping Tonnage

The significance of shipping tonnage, and the simplifying of the maintenance of war apparatus on the other side in view of shortage of skilled labor, as well as shortage of man-power and shortage of foods, are major considerations that must be analyzed in the light of the world aim.

The arguments pro and con regarding the program of standard war trucks by the Quartermaster Department have filled Washington with rumors for several weeks and these arguments are broad and deep in their ramification of the industry, more so than is appreciated by many.

Much Accomplished by Exchange of Views

Fortunately, an industry such as the automobile and truck industry has been schooled in the get-together plan of making progress, and while those holding counter views are yet far from coinciding in action, the exchange of views has already accomplished much, and the continuance of such frank exchange of views should soon clarify the atmosphere in official Washington on this standardized truck problem.

It has been generally recognized for some months that the motor transport requirements of our army should be pooled to give the highest efficiency and to eliminate duplication of effort and other waste. A movement toward this co-ordination was started several weeks ago.

Reports were to the effect that all motor truck activities of the army, except aviation trucks, would be pooled under the control of the Quartermaster Motor Transport Division, which has fathered the standardized truck program and would obviously carry the standardization idea into the other corps of the army. Recently, other rumors became current.

There have been reports that other appointments to control the co-ordinated activities of the army would be made in which the standardized truck program would undoubtedly suffer.

Those deeply endeavoring to interpret the spirit of the war and post-war program of standardization see in the present line of standardized trucks advantages as follows:

Advantages of Standardized Trucks

1. They believe that those manufacturers and others allied with them are really injuring themselves by opposition to the standardized truck program, because this program is so logical and so necessary to the success of our motor transport service, and that opposition will only result in injury to truck makers opposed to standardization if they attempt to satisfy the truck requirements of our army in France with various individual makes. Many of these will find themselves during the war so congested with war work as to have to neglect the commercial field, and in this way allow competitors to gain in their control of this market.

2. That standardization of military motor trucks is essential, because it simplifies and will soon speed up production. It reduces duplication of effort in engineering designs as well as in securing trucks and maintaining them. It reduces very materially the number of different parts to be carried in stock in the foreign repair depots.

3. That production of the standardized trucks, which has already started on the Class B truck has been delayed only because of fuel shortage and will soon be in full swing.

4. That the standardized trucks have proven their practicability, sturdiness and economy by the test drives to which the sample trucks have been subjected since they were manufactured.

Reasons for Opposition

5. That some opposition to the standardized program is due to what might be termed an insufficiently complete analysis of the influence of standardized trucks during the war and after it on the manufacturers building them as well as those not building them.

6. That the standardized trucks have produced opposition because they can be made as cheaply and possibly more cheaply by $500 than the various makes of trucks on the market; this refers to the 5-ton standardized Class B truck, as compared with the average 5-ton truck.

7. That opposition to the standardized trucks is fur-

ther induced by the fact that repair parts costs will be 50 per cent lower on the standardized B truck as compared with some 5-ton trucks.

8. That truck assemblers will be able to make the standardized trucks for commercial use as cheaply or cheaper than they can produce their trucks, and that the assemblers can point to the low repair parts costs and to the fact that the Government has found the standardized trucks worthy and thus create powerful competition.

9. That despite having called in truck makers and others to aid in drawing up the forms of contract which provide for 10 per cent profit for the assembly or manufacture of the standardized trucks, the contract and the profit are not to the liking of some manufacturers who would like 15 per cent profit.

Would Create Competition

10. That because certain passenger-car companies have been given contracts for trucks they will continue to make these trucks after the war and thus provide additional truck competition.

11. That the truck makers and others opposed to a standardized truck program have a plan by which they hope gradually to reduce the importance of the standardized truck, and that that plan includes the appointment of some motor car manufacturer antagonistic to standardized trucks as civilian in charge of a pooled motor transport service and the appointment of another civilian with like policies in charge of the Quartermaster standardized trucks with a view of gradually allowing the standardized program to be curtailed and become an insignificant factor.

Concretely, those not entirely in sympathy with the standardized truck program see the reasons for their attitude as follows:

Reasons Against Standardization

1. That the standardized truck program cannot be fulfilled in the time anticipated and that we will not have the requisite number of trucks for our army unless we use the various makes of trucks available.

2. That the engineers who designed the standardized trucks were granted too much freedom and incorporated many expensive and useless designs.

3. That the standardized trucks of all types are many months behind their original schedules of delivery.

4. That the upright steering post and other features of the trucks will make them impractical.

5. That the Ambulance Corps, which was given considerable consideration in designing the Class AA trucks, they report, refuses to purchase them.

6. That the standardized trucks are more expensive than other makes and consume more fuel.

7. That it is unwise to pause in this emergency and design and manufacture standardized war trucks when we already have many manufacturers with designs, completed tools, machines and factories and organizations ready to produce the various makes of trucks now on the market in quantities to meet our immediate military needs.

It is impossible at this time to vouch for the arguments of those holding varying views on how standardization will in reality evolve and work out in practice not only during war, but after the war, as all parties concerned are not available.

All that is desired is the broadest and most profound analysis of the facts in the case.

The motor transport section of the Quartermaster Corps has denied the report that the Ambulance Corps has disapproved and will not purchase the Class AA trucks. It points to the records established by the sample standardized trucks for proof of fuel economy.

It denies the reports of many months' delay in the production program, admitting that there has been some delay with the Class B truck caused by fuel shortage, but claims this truck will be produced in small numbers this month and will be in large production in March.

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Trader Carbureter For Heavy Fuels

R. V. TRADER & CO., McKeesport, Pa., have developed a carbureter which they claim will operate successfully not only on kerosene but also on fuel oil, the cheapest liquid fuel known. According to Messrs. Trader, the evaporation of kerosene or other heavy fuel depends upon three factors, namely, the surface over which the fuel is spread, the temperature and the rapidity of air circulation. In the following the effects of each of these three factors is gone into at some detail.

Speedy evaporation may be secured by spreading the fuel over a very large surface exposed to the air. This will be readily understood when it is reflected that a small amount of kerosene in an open test tube will lose very little by evaporation in a given time, whereas if the same quantity of fuel were spread over a large surface, say 10 ft. square, it would be evaporated almost instantly. The evaporation may also be accelerated by heating the fuel, or the mixture of fuel and air, or by preheating the air, but the temperature must necessarily be high.

Another way of speeding up the evaporation is to carry off the vaporized fuel as quickly as it formed. This statement may easily be verified experimentally by placing a pan with the fuel in a chamber where the air is motionless and another pan with fuel in a blast of air. The latter will be emptied of fuel much sooner, owing to the fact that the vaporized gases are carried away from the surface of the liquid fuel as rapidly as formed.

In the Trader kerosene carbureter an attempt has been made to meet these three conditions of rapid evaporation. The small quantity of fuel which is ejected from the nozzle at each stroke is spread evenly over the large surface of a rapidly revolving disk. It is there heated by warm air which passes over the surface of the disk in a direction transverse to the motion of the fuel, thus carrying the gases evolved away rapidly.

The main air supply for this carbureter is taken from a stove on the exhaust pipe. The air passes from this stove into the throat of a small air turbine, where it is directed against the turbine blades, revolving the assembly of turbine motor, disk and shaft. This warm air revolving in the turbine housing is in direct contact with the disk and evaporates the fuel spread thereon by the nozzle; it then passes around the circumference of the disk over the circular, exhaust-heated hot spot on the casing of the disk. The theory is that the combustible mixture passes this hot spot at such high speed that it will not be appreciably heated, but should any drops of liquid fuel pass around the edge of the disk, owing to their greater inertia they would be thrown against the hot spot, where they would immediately be turned into vapor. The mixture enters the throttle passageway through a throat directed so that the air from the auxiliary air valve at high speeds will surround the gas in its passage to the manifold.

The Trader kerosene carbureter should preferably be used with a cast-in manifold. A carbureter suitable for a four-cylinder, 3¾ by 5¼ in. engine at normal speed in truck service will have a disk speed of from 600 to 2800 r.p.m. and the disk area is 12.56 sq. in. The temperature of the air entering the main inlet is said to be about 200 deg. Fahr. at low speed and not much above 225 deg. at higher speed. Of course, the evaporation of the kerosene materially reduces this temperature.

The Benz 230-Hp. Aircraft Engine

Forced Lubrication by Means of a Gear Pump—Gasoline Pump Delivers Fuel to Carbureter Under Pressure

(*Continued from February 14 issue*)

THE dimensions of the inlet and exhaust valves are the same, so that the weights are identical, each valve weighing 1.25 lb. The lift of the inlet valve is 0.465 in., and the lift of the exhaust valve 0.443 in., while the clearance of inlet tappet is 0.009 in., and the exhaust 0.015 in.

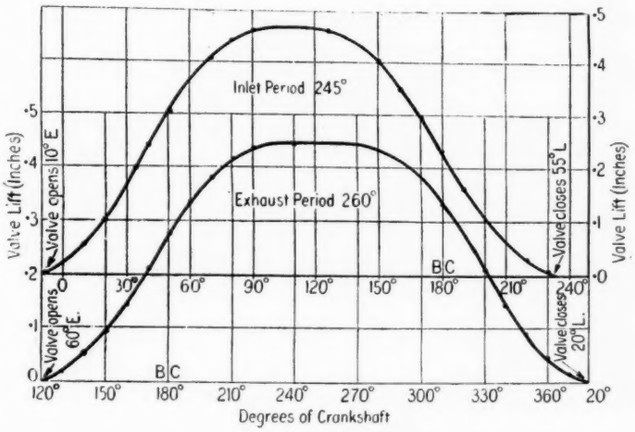
The hollow camshafts run in three plain phosphor bronze bearings of much the usual form. They are 53 mm. outside diameter, split on the camshaft axis and held together by wire rings on either side to allow the camshafts to be easily assembled in the crankcase. They are located by grub screws inserted from the outside of the casing.

The camshafts are driven by straight-tooth gears, in the usual manner, through an intermediate wheel that meshes with the crankshaft pinion. The gearing is arranged in the orthodox casing formed at the rear end of the crankcase, and the camshaft gears are bolted to the flanges on the camshafts, drilled to provide a vernier adjustment for setting the camshafts.

The half compression cams on the exhaust camshaft are engaged by lateral movement of the shaft, effected by a two-start square-thread screw of 24-mm. pitch, operated by a small lever at the rear end of the crankcase. The camshaft is returned to its normal running position by a spring inside the front end of the shaft. The half compression cams open the exhaust valves at 35° E. and close at 22° L.

Crankcase

The crankcase is shown in the general arrangement drawing of the engine, and it will be noticed that the method of cooling the interior of the crankcase and sump indicates that this point has received careful consideration. In the top half of the crankcase six of the seven main bearing housings are so cast that the webs form air passages transversely across the engine, and two of these passages form the air intakes for the two carbureters—an arrangement similar to that adopted on the 160-hp. Benz engine.



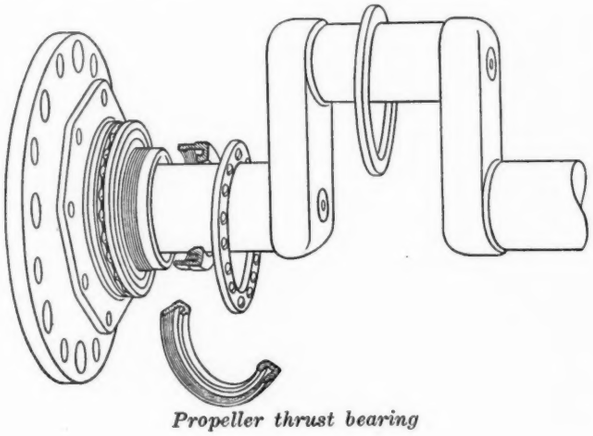
Valve lift diagram

The bottom half of the crankcase is extended to form an oil sump, and is of rather unusual design. The lower portion is cooled by eighteen 30-mm. aluminium tubes arranged transversely across the chamber, the air being collected into the tubes by a large louvred cowl of sheet aluminium, attached to the induction side of the engine. A corresponding but reversed cowl is fitted on the exhaust side. Breathers are also fitted in the top half of the crankcase; the simple type of wire spring clip fitted to the breather lids will be noticed.

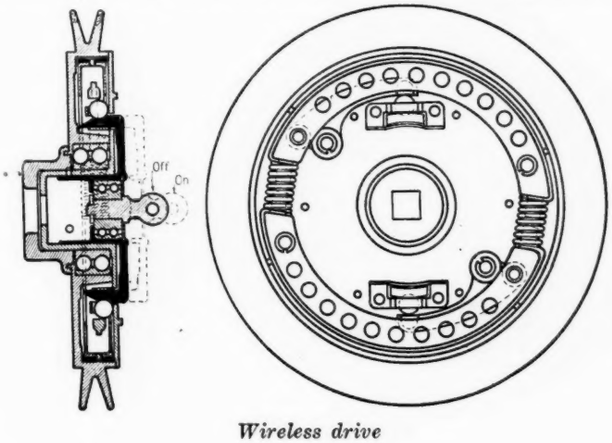
Carburetion System

Two separate carbureters are fitted, each feeding three cylinders. These are attached by flanges to the side of the top half of the crankcase.

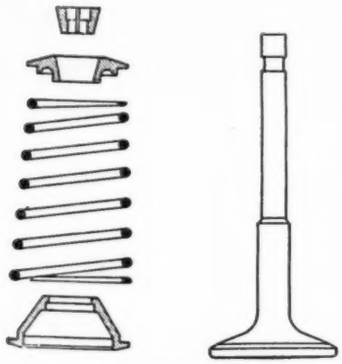
By reference to the drawing of the carbureter it will be seen that the pilot jet is formed by an extension of the brass tube into which the main jet is screwed. This combined jet is screwed obliquely into the bottom of the float chamber casting, and not, as is usual, into the body of the



Propeller thrust bearing



Wireless drive



Valve and spring

carbureter. Attachment of the float chamber to the body of the carbureter is effected by two bolts.

As already mentioned, the main air intake passages are cast in the crankcase between the webs of the main bearings, air entering each carbureter through two ports in the end of the throttle and also through the air passage at the base of the carbureter below the jets. At full throttle most of the air is taken through the air ports in the throttle above the jets, but when the throttle is closed for slow running the main jet is completely cut off and all the air is taken through the passage containing the pilot jet. When tested, the slow running of the engine proved to be very good.

The design of the air intake ports in the end of the throttle is shown in one of the drawings, which illustrates the throttle in half and full positions. The ports are so designed that the gasoline-air ratio remains practically constant over a wide range of throttle opening up to nearly half throttle; the last movement of the throttle, however, causes no increase in fuel flow, but, on the contrary, a slight decrease. The body of the carbureter around the throttle is water-jacketed, and is connected by an arrangement of steel piping to the delivery of the water pump, and also to the lower water connections at the bottom of the water-jackets between each pair of cylinders. The arrangement is clearly shown in the side view of the engine. No compensating arrangement is fitted for high altitude control.

The design of the branched induction pipes is interesting; they are built up of aluminium tubes with cast aluminium-flanged bends, and weigh only 2.625 lb. each complete with connections. The internal diameter of the induction pipe is 58 mm., and the connections between the flanged bends of the induction pipes and the cylinders, and also between the bottom ends of the induction pipes and the carbureters, are made with rubber ring joints secured by wide band clips. These joints when loosened, being more or less flexible, allow any one of the cylinders to be removed without disturbing the other joints of the induction branched pipes. The Royal Aircraft Factory test report computes the petrol consumption at 150 pints per hour, or 0.65 pint per brake-horsepower hour.

Lubrication

Forced lubrication of the crankshaft and connecting-rod bearings is effected by a small high-speed gear pump working submerged in the reservoir formed in the bottom of the sump. The pump is virtually a triple one with three functions, and its details are fully illustrated herewith. It works diagonally in the sump, and is driven through a long shaft by a gear that meshes with the distribution pinion on the rear end of the crankshaft.

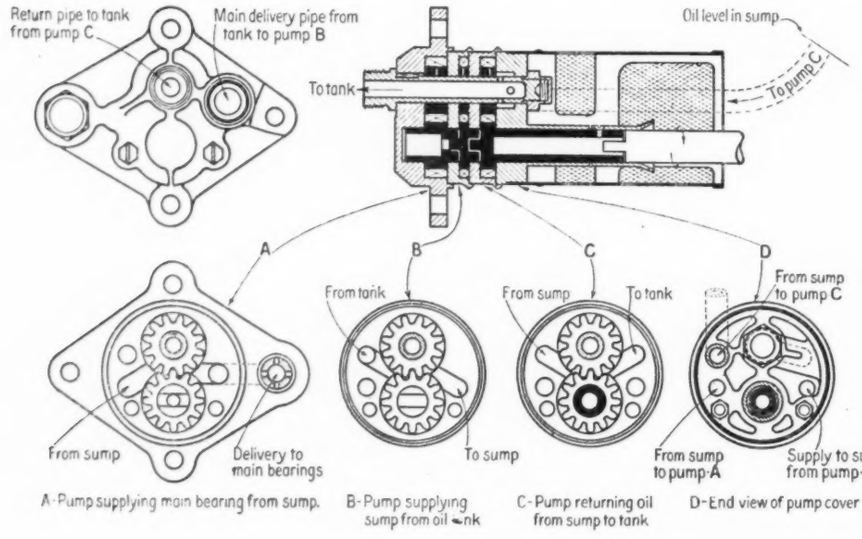
Referring to the diagrams of the oil pump, the operation of it is as follows: Oil is drawn by the main pressure pump *A* from the reservoir in the sump through the holes in the end cover of the pump, lubricating the main bearings through the main oil pipe and the small branch pipes and hollow crankshaft. Thence delivery proceeds to the piston-pin bearings through the small pipes inside the tubular connecting-rods, and the surplus oil thrown out from the hollow cranks on to the camshafts, etc., returns by gravity to the sump, flowing over the air-cooling pipes in the base. Fresh oil is fed into the sump by the small suction pump *B* from the oil tank, while the correct working oil level is maintained in the reservoir by the gear pump *C*, the oil being drawn off through the bent pipe *E* and returned to the oil tank. The fresh oil from the oil tank passes through a cylindrical gauze filter attached to the under side of the crank case.

Oil Pump

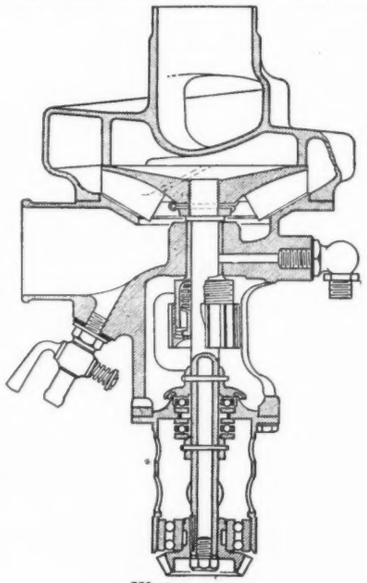
The complete oil pump with its filter is easily detachable from the sump, being held in position by studs through the flange. A small spring-loaded ball valve provides the oil pressure release in the main oil supply pipe. The gears of the oil pumps and also the pump body are of cast iron. The weight of the complete pump is 2.89 lb.

Oil consumption during a Royal Aircraft Factory test was 4.5 pints per hour, equalling 0.02 pins per b.hp.-hour. The working oil pressures are 50 lb. maximum, 28 lb. normal.

Two Z.H.6 magnetos are mounted on brackets at the rear end of the crank case, and are driven off the cam-



The triple oil pump



Water pump

shaft gear wheels. The scheme of the drive is neatly carried through, and is clearly shown in the rear end view of the engine. Ignition control is effected by small-toothed quadrants that mesh with teeth cut in the under side of the magneto cam box. The interconnected levers of the timing control quadrants are coupled by a rod which passes through the end of the crank-case casting.

Two spark plugs are fitted to each cylinder, one on each side, and the high-tension wires are carried in a sheet aluminum casing attached to the cylinders. The ignition is timed as 30 deg. early fully advanced, *i.e.*, 18 mm. on the stroke.

Water Cooling

The centrifugal water pump is arranged on the top of the rear end of the crank case, the vertical spindle of the rotor being driven by bevel gears off the camshaft intermediate pinion, as shown in the large general arrangement drawing of the engine. The speed of the water pump spindle is 1.58 to 1 of the crankshaft, and the diameter of the rotor is 120 mm. The diameter of the water inlet to the pump is 50 mm., while the diameter of the outlet is 55 mm. Water enters at the top of the rear cylinder through the steel tube elbow, and, as previously mentioned, is deflected around to the exhaust passage of each cylinder. A double thrust ball race is fitted to the spindle, which is provided with a large stuffing gland; the spindle is lubricated by a grease lubricator operated from the pilot's seat.

From a separate test of the pump carried out at the Royal Aircraft Factory, in which the pump was removed from the engine and coupled to an electric motor, the following results were obtained, running at an average speed of 2100 r.p.m., equivalent to 1325 r.p.m. of the crankshaft:

Maximum delivery = 120 gal. per min. with free outlet.
Minimum delivery = 48 gal. per min. against a pressure of 7 lb. per sq. in.

A diagram of the complete water-cooling system is shown, and from this it will be seen that the greater part of the water is forced by the pump directly through the cylinder heads in series, while the bottom portion of the cylinder water jackets is supplied through a branch pipe arranged just above the outlet of the water pump. This branch pipe is also connected to the carbureter water jackets, as shown in the diagram.

Water Connections

The water connections between the heads of the cylinders are made by rubber rings contracted by steel band clips of ingenious design. The strap of the clip is a thin strip of annealed spring steel, and this passes twice round the rubber ring, after which it is pulled up and fastened by a bolt in the link. In making the joint, the end of the steel band is first bent over the bottom bolt of the link and then twice round the rubber ring, the free end of the steel band passing through the center portion of the link on the second winding, when the end of the steel band is then fastened to the top bolt by inserting it into a slot suitably cut. Evidently when this bolt is rotated, the steel band is pulled tightly round the rubber ring and remains thus. The water capacity of each cylinder jacket is 1873 c.c., and the total amount of water carried in the engine, apart from the radiators, is 30.9 lb. Two rectangular honeycomb radiators are fitted, one on each side of the machine.

The automatic fuel pump constitutes one of the most interesting features of the engine, its function, of course, being to supply gasoline under pressure to the carbureter without the disadvantages of gasoline tanks under pressure. The pump is used in conjunction with a supplementary pressure reservoir inside the main fuel tank, and the system includes an auxiliary fuel tank and semi-rotary hand pump. Details of the main pump are shown in the general arrangement drawing, and its function and operation, together with the supplementary pressure reservoir, are explained by the diagram.

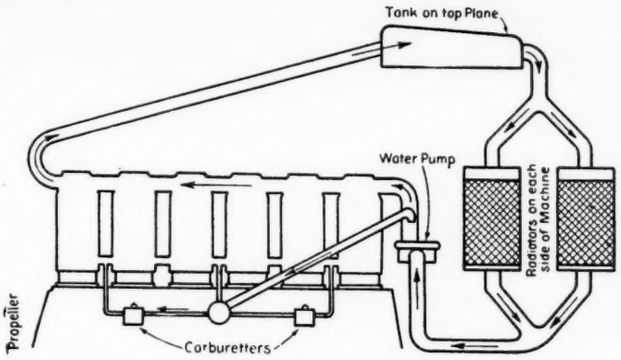
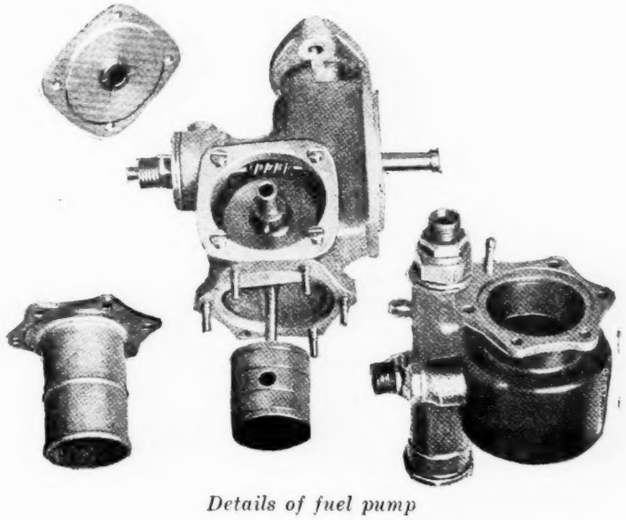


Diagram of cooling system

In its essentials the pump consists of a small piston of cast iron, 40 mm. in diameter, working in a cylinder of phosphor bronze, open at both ends. The piston is arranged below the crank, and the lower portion of the cylinder extends nearly to the bottom of a chamber, which contains castor oil. The piston is actuated by a connecting-rod, driven through worm gears by a spindle forming an extension of the inlet camshaft.

With regard to the operation of the pump, gasoline from the main tank enters the pump through the filter at the side, and on the upward stroke of the piston producing falling of the castor oil, gasoline is drawn into the annular chamber through the inlet or lower check valve. Upon the downward stroke of the piston, the gasoline charge, above the castor oil column, closes the inlet check valve and forces the charge out of the upper valve. The volume of gasoline discharged at every stroke corresponds, of course, to the displacement of oil by the stroke of the piston.

From the delivery of the pump gasoline is forced into the top of the pressure reservoir inside the main gasoline tank, and, rising in the reservoir, creates a cushion of compressed air above the gasoline, thus serving to damp out the pulsations arising from the action of the pump. From the bottom of the pressure reservoir the gasoline is forced upward through the shorter of the two pipes inside the reservoir, and is delivered at even



Details of fuel pump

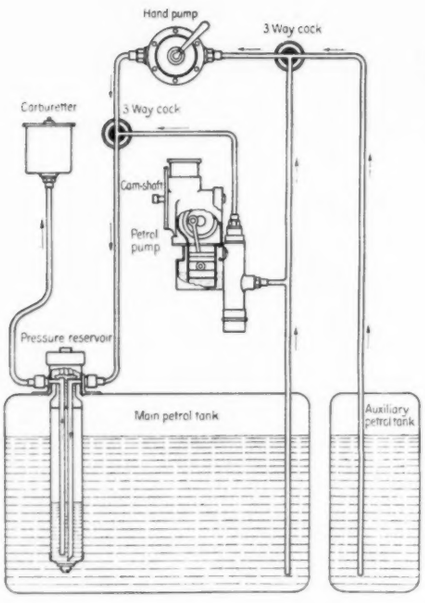
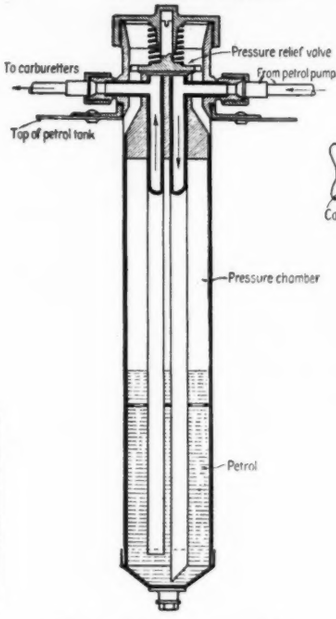
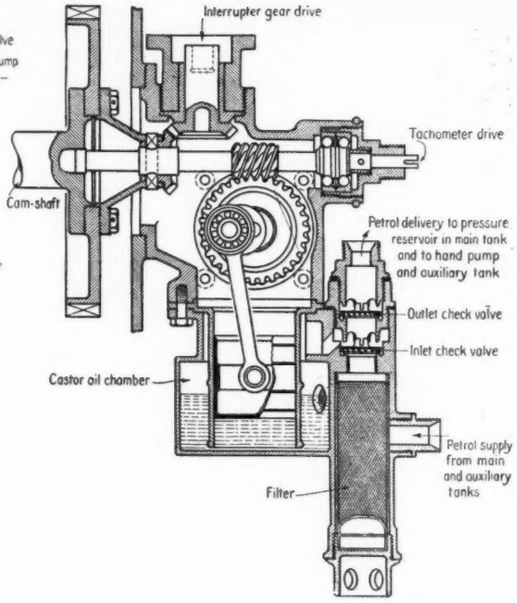


Diagram of fuel supply system



Fuel pressure reservoir


Interrupter gear drive
Tachometer drive
Cam-shaft
Petrol delivery to pressure reservoir in main tank and to hand pump and auxiliary tank
Outlet check valve
Inlet check valve
Castor oil chamber
Petrol supply from main and auxiliary tanks
Filter

General arrangement of fuel pump

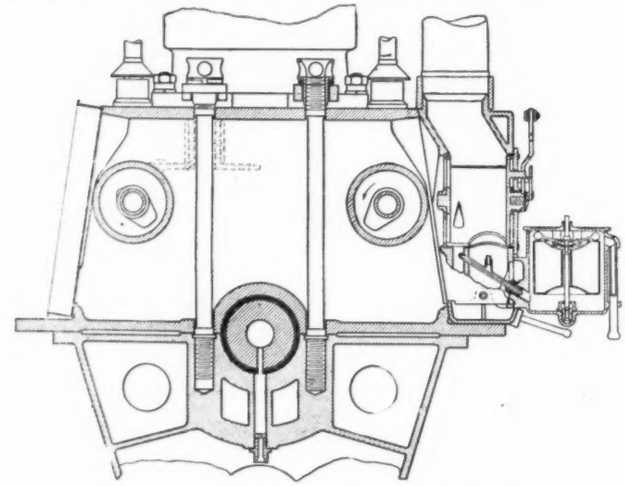
pressure to the carbureters. A pressure relief valve is fitted to allow excess gasoline to return to the main tank, which is effected through twelve holes drilled in the head casting of the pressure reservoir.

As illustrated in the diagram of the fuel system, a supplementary supply system is embodied, employing an auxiliary fuel tank and a semi-rotary hand pump in conjunction with the main system. Two three-way cocks are fitted, which allow any one of the following three means of supply to be utilized:

(*a*) Main gasoline pump from main tank.
(*b*) Hand pump from main tank.
(*c*) Hand pump from auxiliary tank.

The driving spindle of the gasoline pump also drives through bevels a vertical spindle operating the interrupter gear for the machine guns, while to the rear end of the pump spindle is fitted the flexible tachometer drive.

In the earlier types of gasoline pumps fitted to the Benz engines the castor oil chamber was provided with an oil-filling cap, which was screwed into the side of the chamber casting, and was fitted with a special form of drain cock to determine the quantity of oil poured into the pump. This filling arrangement has now been given up, and the annular oil chamber is fitted with a drain plug only.



Arrangement of carbureter and air intake

The following data in connection with the pump will doubtless be of interest, and attention is drawn to the tabulated test results of the Royal Aircraft Factory given below:

Speed ratio of the driving spindle to the small crankshaft driving the piston of the fuel pump.	10.75 to 1
Bore of the pump	40 mm.
Stroke of the pump	26 mm.
Lift of valves (inlet and exhaust)	2 mm.
Volume of gasoline delivered at each stroke of the pump	2 cu. in. (approx.)
Weight of complete fuel pump	6.75 lb.

The normal consumption of the engine is approximately 150 pints per hour at normal speed, and the pump has a greater delivery than this at any angle up to 60 deg. in any direction.

The maximum delivery of the pump in a vertical position is 288 pints per hour at 10 lb. per sq. in., running at 850 r.p.m. At normal speed, *i.e.*, 700 r.p.m., the delivery is 233 pints per hour; while at speeds in excess of 750 r.p.m. the inertia of the fluid columns causes displacement of the castor oil.

The pump was run for ten minutes with the piston in direct contact with the gasoline, with no deleterious effect, but a test of such short duration is, of course, practically valueless as being any indication of the possibility of permanently so running the pump.

A number of tests were carried out to determine the rate of flow, also the inlet and outlet pressures of the pump, while tilted at the angles likely to occur on a machine in flight. The effects of banking to the right and left, diving and climbing were thus shown, and the results are given in the diagram.

(*To be continued*)

IT is reported that German airplane constructors, instead of using mahogany and walnut for propellers, are using softer woods of different kinds laminated together. Experiments made to determine the strength of these propellers show that with the wood skilfully compacted together these propellers are as difficult to break as the best hardwood propellers. It must be remembered that the extreme strain necessarily makes the life of even the best propeller comparatively short, and there is something to be said for the view that efficient and durable propellers may be made from comparatively cheap timber.

Automotive Design and Transportation as Developed by the War*

Purchasers No Longer Choose a Car by Size and Weight —Economy of First Cost and of Upkeep the Deciding Factor—Tendencies in Design Revealed by New Models

By J. Edward Schipper

WE are to-day face to face with a condition in automotive engineering that would have been 3 years or more removed if it had not been for the war. War demands a general speeding up, and the methods of peace times no longer suffice.

One of the great problems which confront the world to-day is that of transportation. Under the demand for the movement of unprecedented quantities of materials and manufactured articles, as well as that of greatly increased passenger traffic of a military and commercial nature, the nation's railroads have been strained to the breaking point.

When it is considered that owing to heavy government purchases, more money is being spent for manufactured goods in this country this year than was spent in a period of many years previously, and that as a result every productive industry in the country has been pushed to the limit, it is not hard to understand that the weak links in the chain of our transportation system should give way.

Both within and without the country we must keep things moving. We must move fuel, materials, manufactured articles, food, clothing and armies. Transportation is the big demand of the age and with the railroads of the country taxed to their limit, it is automotive transportation that must be resorted to.

New Measure of Distances

A century ago ideas of distance were gaged by the abilities of the horse. If we thought in terms of the horse to-day we might just as well surrender, yet there are over one hundred millions of acres of land cultivated annually in this country to support the horse. Nevertheless, the days of thinking in terms of the horse in transportation are gone. Quick transportation, certain transportation and above all efficient transportation is the greatest demand of the age. Let us see how the automotive industry fits in with this demand.

The change from a year ago to now has been a change of peace to war. We have been awakened from our gilded dream to find out that our Chinese wall of internal self-sufficiency has crumbled. It has crumbled largely because transportation has advanced to such an extent that countries which, in the days of "no entangling alliances," were remote, have become our next door neighbors. This great change has been accompanied by a revulsion of feeling in this country, which would have been considered impossible.

A great wave of economy has swept over the country. Our great national fault has been extravagance. We have been extravagant of every resource. The great forests which once covered the country have been cut away so that to-day lumber is cheaper in the oldest countries of the world than it is here. Our minerals, the game of the fields and forests, all the gifts that nature bestowed on this country have been used in a lavish way and naturally along with this the habits of our people have been affected until we have become known as the most wasteful nation in the world.

This characteristic has been reflected quite clearly in our automobiles. The American people have been buying cars by size. They have been buying cars by the pound. If two cars were offered side by side, at the same price, but one larger and more gaudy in appearance than the other, there would have been no possibility of one competing with the other, as the larger one would have nearly all the sale in spite of the fact that the other might be a better piece of engineering. But a change has come.

We have suddenly awakened to the fact that the automobile of to-day is not efficient and not economical and at the same time the people of the country have been awakened by the exigencies of war to the fact that our daily habits, whether they are concerned with transportation or what not, must be more efficient and economical.

The result is that to-day people, when they are purchasing goods, want the most for their money. When they buy transportation they want the most transportation for the money they spend in the purchase and afterward in maintenance and for supplies.

Too Much Dead Weight

When we say the automobiles of to-day are inefficient, and are not giving the owner the value in transportation that they ought for the money expended, we simply mean that what he gets back in transportation is not enough in proportion to what he puts in.

Take for instance the man who owns a car weighing 2½ tons who drives downtown to his office, a distance of 5 miles. In the evening he returns, another 5 miles. If a friend were to offer to take him to his office and back for a dollar a day, he would probably laugh at him. Yet in all probability this is what it is costing him. The upkeep of such a car, even without including the depreciation which we all know is high in a car of this weight, will easily amount to 10 cents a mile.

The car weighs too much for the passenger load. The man weighs probably 150 lb. The car weighs 5000 lb.; in other words, 33 lb. for every pound of passenger weight. This is too much. The car is heavier than the average, it is true, but this example is taken merely to illustrate the point. Even with five passengers in the car, the weight would be over 6 lb. per passenger and this is too much.

Ton-Miles and Comfort the Objects

Study this from the transportation efficiency standpoint. We have two sides to the ledger sheet, on one side what we put in and on the other what we take out. We put in money in terms of fuel, time, weight of vehicle, labor (if a driver is employed), road or track maintenance and vehicle maintenance. We take out just two things: passenger-miles and comfort. The comfort comes extra in an automobile as it does on a Pullman car. In a commercial vehicle it is ton-miles alone.

We have got to get the best results possible and at the same time to keep the cost down to the limit. Most of the cost factors are in the control of the engineer, and, indeed, most of them are simply weight factors. Taking them one by one:

*Paper read before Detroit Section Society of Automotive Engineers, Feb. 21.

Fuel Consumption—Primarily affected by weight and to a moderate extent by design in average practice.

Time—Controlled by law and traffic conditions.

Weight of Vehicle—The real crucial factor involving displacement and weight of powerplant, length of wheelbase, physical qualities of materials, vehicle characteristics and purposes.

Road or Track Maintenance—Covered by state tax and a function of weight and horsepower in many states.

Vehicle Maintenance—Function of weight, materials, design, handling, road conditions and a number of other variables.

In every one of these items we have been high in the past and we must make a rapid change to reduce them if we wish to fit in with the desires of the public. If the progress of the times is to be studied, it must be done with the broad fundamentals outlined carefully in mind.

No War-Time Cars Yet

The new cars at the shows are hardly war-time cars. They have been out on the road under test for so long that they antedate the economy wave which has swept over the country. All that they serve to show is that the tendency was in the direction of what has now come to be a demand. This demand in a great many ways is not even known to the people themselves, yet it is there. The attitude of the people at the shows was to a large extent noticeable. They were searching for something they did not find and so they took the nearest thing to it, or, took nothing at all.

These people were looking for a car in which the weight per passenger was at the lowest limit. In other words a car that utilized every inch of wheelbase to the greatest possible efficiency; that was not of a displacement higher than necessary to carry the load; that had materials which returned the greatest amount of service because of their light weight and scientific disposition.

No longer were they looking for the biggest car that they could buy for a certain sum of money. The American public have had a psychological shock from which they have not recovered. It is to be hoped that they will not recover because the new condition is a healthy one begetting a higher plane of mental and physical existence. It devolves upon the automotive industry to design tools which suit this new state of mind. We must have efficient transportation.

At this time of the year when all the new cars have made their appearance and the designs for the following season have all been disclosed we are naturally interested in seeing the trends of development. This year, for the reasons pointed out, the trends can not possibly teach us as much as in the past because the designs in which they are included can not possibly have taken into consideration the change of the national psychology. Nevertheless, since we were beginning to move in the right direction it is important to study these developments to see what should be accelerated in order to meet the new conditions and new standards. We must hold up the past tendencies to the spotlight and see what conforms to our new demands for conservation and economy.

Only Five New Chassis at Show

At the shows there were but five really new chassis, incorporating new powerplants and redesigned to a sufficient extent to really classify them as being absolutely new. During the year two additional chassis which can really be classified as new were brought out. This gives a total of seven entirely new chassis which were not on the market a year ago. All of these have new powerplants and are the latest types under normal development. It is interesting to note that of the seven, five are four-cylinder and five have over-head valves.

Nothing radical is to be noted in any of these cars except that the leaning toward overhead valves is becoming stronger year by year. The conclusion cannot be avoided that an unqualified indorsement has been placed upon the overhead valve engine by the industry. The fundamental reason behind this development is naturally the effort to secure the greatest possible output from a given displacement. To secure high volumetric efficiency combined with a minimum loss through wall cooling a construction must be used permitting of the most direct entrance into the combustion chamber and of the most advantageous combustion chamber shape.

If we were to take all the American passenger cars on the market and strike a general average, the cylinder size would be 3½ by 5 in., and the average displacement, taking account of cylinder numbers, would be 269 cu. in. To look at this from the standpoint of engines of different numbers of cylinders, the following averages obtain:

No. of cyl.	Bore	Stroke	Piston Displacement
4	3.6	4.95	221
6	3.46	5.00	282
8	3.13	4.59	282
12	2.87	4.96	386

Contrary to what has been outlined as the probable future development of passenger car engines, the average engine is larger to-day than it was a year ago. The piston displacement is now 269 cu. in., as compared with 222 formerly. The gear ratio has been altered from 4.15 to 4.22, yet the increase in average tire size from 31 to 34 in. has prevented a large increase in the displacement per mile on high gear. A year ago this averaged 384 cu. ft. It is now 388 cu. ft. Thus, although actual engine displacement has increased, car ability as measured by displacement per unit of distance has not increased.

Overhead Valve Gaining

A census taken before the shows indicated an increase in overhead valve construction of 2.2 per cent with a corresponding reduction in L-head engines. The additions to the the list as brought out by new cars at New York and Chicago bring the increase in overhead valve engines to about 3 per cent. The percentage is rather lower than it ought to be, because the assembled cars practically all use L-head engines, due to the fact that the largest builders of stock powerplants confine their efforts to the L-head type. As each selection of an engine represents what might be called an engineering ballot in favor of that type, it is fair enough to take the chassis and obtain the average as given.

Probably one of the results of more carefully shaped combustion chambers, combined with a continued tendency toward larger valves, more scientific cam contours, better designed intake ports and galleries, and superior carburetion due to the development of the hotspot manifold and carbureter mixing chambers giving better velocities is that mean effective pressures have been increased.

More Radical Changes Next Year

If automobile factories get the opportunity to carry out designs which are being suggested by the changed attitude of automobile buyers, the changes made during this season will be more radical than anything in the last decade. There has been no incentive for the engineering department to make every inch of wheelbase return an inch of body space, riding comfort, or other concrete quality. The reason for this is that we have had more than enough wheelbase. At the present cost of materials and with the present objection of the public to carrying around any more useless car weight than is absolutely necessary, manufacturers are not going to be as wasteful of car length.

What can be done in this respect is hardly appreciated. For example, one concern which brought out an entirely new car this year shortened the wheelbase 7 in. and after rearranging the layout had as much room in the tonneau as in the previous model and 2 in. more in the front compartment. This result was not arrived at in an attempt to cut wheelbase length to the limit, but was more or less incidental to a design intended to be more economical than and equally good in performance as the previous model. With more passenger space and a smaller engine, a gain of 50 per cent in economy of fuel, and a large cut in weight, and a better performing car was secured. The improvement in performance covered acceleration, low speed torque, and speed range on high gear.

Engineering Talent Engaged on Other Problems

In an analysis of this kind, it is only fair to remember that it has been impossible to realize many of the anticipations of a year ago, owing to the fact that the minds of engineers who

would ordinarily be on development work have been employed on the vast task of designing and making ready for the production of government necessities. Another matter which has retarded development has been the scarcity of materials which normally would have come into their own this year. Without doubt aluminum would have been employed to a greater extent than ever before, but the fact that it remains scarce and expensive has prevented its use on any but high-priced products.

To come to some of the details in which alterations have been made during the year, the detachable cylinder head is one of the most significant. All the new engines brought out during the year have this feature, and, in addition, makers who have not employed the feature before have adopted it. Two Detroit makers, one manufacturing a high grade twelve, and the other a high grade eight, have changed over to the detachable head, showing that its practicability is recognized on the V engine as well as on the vertical. The early difficulties have been solved and they have been found to be due to two main causes, either insufficient metal around the studs, or insufficient water space permitting circulation around the head. Care has to be taken that the tension on the cylinder head retaining studs does not distort the valve seat.

Cold Weather Starting Devices

For 3 years the fuel question has been exerting a highly important influence on engine design. This year there has been a crop of the so-called hotspot manifolds. There is no doubt that the use of these has resulted in a material reduction in the warming-up period. This is of considerable importance, as with the highly efficient choking devices employed on up-to-date carbureters, a stream of raw gasoline is drawn into the cylinder during the cranking period and naturally some of this is sure to leak past the piston rings, with the result that considerable crankcase dilution occurs, destroying the lubricating qualities of the oil.

Cold weather starting is engaging the attention of automobile engineers, and during the year many suggested means have been offered for solving the difficulty. Probably the most promising of these is the method by which a small electric coil is employed to heat a small quantity of gasoline, which is thus evaporated, throwing into the cylinder a drier product which facilitates combustion and lessens crankcase dilution. In one of these primers, the electric coil is in the float bowl of the carbureter, and in another a cylindrical well is employed of slightly larger diameter than the pencil shaped coil.

Single ignition has been continued and has been improved in detail. The battery, breaker mechanism and coil have all been improved. One concern has developed a battery in which rubber separators are used with threaded wicks which carry the active material in the desired manner. Both breaker boxes and coils are faster than ever, this being necessary to take care of the increased crankshaft speeds at which engines are running. Platinum and tungsten for breaker points are scarce, making it difficult for manufacturers to keep up the quality.

Engine Balancing

Engine balancing has been studied more carefully than ever and counter-weighted four-cylinder engines are more numerous than before. Inherent balancing in which the rotary balance of the shaft is taken care of in design is also meeting with favor. In connection with the crankshaft the question of lubrication naturally arises, and it is interesting to note that pressure feed for the main bearings is increasing. While the percentage does not show up very high, owing to the fact that there have been some new models added which neutralize the figure, the proportion of engines with drilled crankshafts is increasing. In practically all cars selling at a price which renders it possible to afford the cost of drilling the shaft, this method is being used.

Leaving the power plant and in examining the rest of the chassis, it will be noted that the average wheelbase has increased by 7 in. It is safe to assume that this will not be the case another year. The fundamental reasons noted at the beginning of this paper preclude the possibility of again adding weight unless there is a very good reason for doing so.

As a matter of fact, the 1917 chassis has not followed out the curve of weight reduction which past trends would indicate. The abandonment of alloy steel wherever it is possible to get a reasonably satisfactory substitute of carbon steel may have something to do with this. Another reason for increased weight is in the deeper frame sections which are now employed, although this depth is necessitated by the longer wheelbase. The increased depth has been accompanied by a tendency toward longer springs of the semi-elliptic type. The latter form of suspension in combination with the Hotchkiss and other drives is growing in popularity. There are now only three cars which use full elliptic springs. Three manufacturers also continue to use the platform spring, there having been a notable conversion in this respect by one of the concerns making twin sixes. Hotchkiss drive is used on 53 per cent of present-day American chassis.

Clutch Operations Made Easier

Clutch adjustments continue to decrease. The success of the light types now on the market has been proved. The problem of securing the lightest and most efficient clutch to transmit a given torque has been studied very carefully during the past few years, and at the present time clutches are easy to disengage. The fact that with the powerful clutch springs the clutch pedal can be disengagd on some cars with the hand indicates how the travel of the engaging members has been shortened. The use of fewer disks has contributed to the shortness of travel and is one of the factors which is making clutches lighter.

In chassis fittings a marked trend toward the more extended use of forgings for brackets, axle parts, etc., has been somewhat checked by the abnormally high prices asked for forgings at the present time. The result of this has been a temporary tendency toward an increased use of malleables. Manufacturers have been forced, in some instances, to change from forgings to malleables and in a few instances from malleable to steel castings, simply because of the difficulty in obtaining delivery of certain parts.

Malleable Castings Replace Forgings

Further than this, in view of the present prices of forgings, malleables are being used for some parts where the size is a matter of convenience rather than of structural strength. In a great many trucks which ordinarily would employ forgings, practically all of the frame brackets, spring hangers, motor brackets, etc., are of malleable iron. All parts which are in tension, and particularly those which are under shock, such as shackle links, are made from forgings if possible, or else from steel castings.

For the vital parts of all trucks and passenger cars forgings will continue to be used. This refers particularly to such parts as axles, steering connections, propeller shaft parts, etc. It is this condition which has put a check for the time being to the big trend toward forgings and stampings, but as soon as the war is over and conditions are relieved it is certain that the forgings and stampings will once again come into their own.

A very prominent engineer in charge of motor truck construction in this country states that the following rules guide him in selecting cast steel, malleable and drop forgings for small brackets, axle parts, etc.:

1. Cast steel is used for more important structural parts that cannot be forged. It must be made fairly heavy to allow for segregation in the castings, blow holes, etc. It should really only be used for complicated pieces.

2. Drop forgings should be used where very great strength is required, with lightness.

3. Malleable iron should be used for unimportant structural parts, such as spacers, packing pieces and the like; parts where cast iron itself would probably be strong enough as regards the actual work to be done, but not strong enough to bear transportation and rough handling.

4. In general, it is a very wise rule to use forgings as much as possible, as after the first cost of dies, they are usually found to be cheaper and much more homogeneous.

Bodies generally have been altered only in exterior lines; the beveled edge is typical. There has been a slight ten-

(*Continued on page* 463)

Express Service Over the Road By Motor Truck

Goodyear Has Seven Pneumatic-Tired Trucks Operating on Regular Schedule Between Boston and Akron—Round Trip, 1480 Miles in 6½ Days

By Joseph Husson

ONE of the greatest steps yet taken by any one company in the development of overland truck transportation has been made by the Goodyear Tire & Rubber Co., Akron, Ohio. That company began the operation of its first truck overland between Akron and Boston on April 9, 1917.

It now has seven trucks running overland between the same points on a regular schedule. What is even more important, these trucks have been operated through the deep snows of the present winter. Of course, there have been delays and interruptions of the service for short periods as required when breaking through new roads or when mechanical trouble on the trucks was encountered. But no truck that started from either end of the route has been forced to return and abandon the trip.

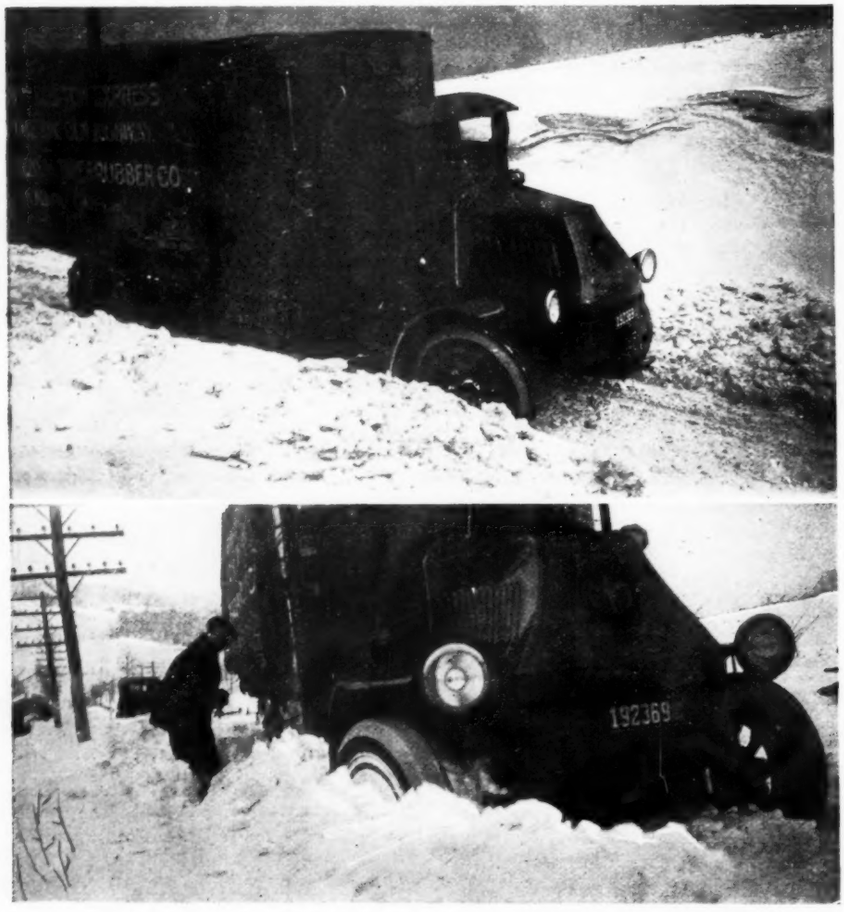
Tire Test Original Idea

The operation of trucks overland by the Goodyear company was started for a dual purpose. The principal reason was to test out the giant pneumatic tires being produced by the Goodyear company. The carrying of goods as a useful load was a secondary, but necessary, requirement in order that the tires being tested would have to undergo the same conditions as they would meet in actual service.

The makers of the first truck put into service, a 5-ton Packard, were very skeptical as to the feasibility of the project, but the Goodyear company insisted and finally started the vehicle on the first leg of its journey from Akron early in April of last year. The trip took 17 days. To-day the same truck and others of the fleet are making the identical run in 4 days, and in several instances a complete round trip of 1480 miles has been made in 6½ days. One of the late additions to the fleet, a 3½-ton Mack, recently made the trip between New York and Akron, a distance of 533 miles, in 60 hours, total time, and in 49 hours actual running time. The roads were deep with snow all along the route and the thermometer registered 13 below zero for a considerable portion of the run. Due to the fact that the truck was fitted with giant pneumatic tires all around, it was able to make a speed which would have been impossible with tires of the solid variety. Notwithstanding that the Pennsylvania mountains had to be crossed on the trip, the vehicle averaged 10.9 m.p.h. actual running time.

Since the first truck was installed, the Goodyear company has added six others, the last going into service during the present week. Two 5-ton Whites were put into the work after the initial Packard had been bought. A 3-tonner of the same make was next added, followed by a 3-ton Packard. A 1½-ton White was then purchased, and recently a 3½-ton Mack. The latest truck to go into service is a second 3-ton Packard truck equipped with the engine usually fitted on the 5-ton size.

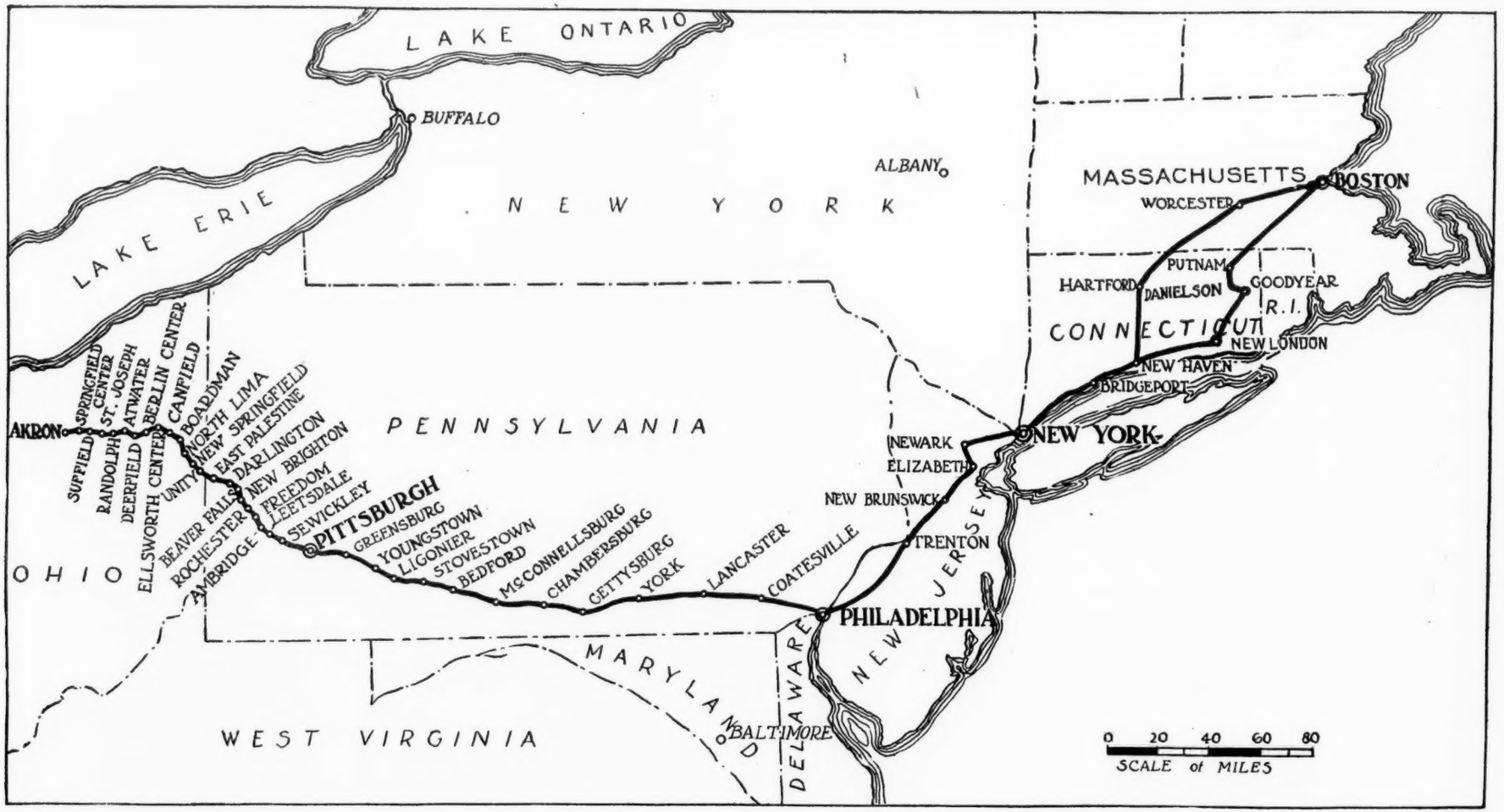
The experience gained by the Goodyear company during the 10 months it has been operating the trucks will go a long way toward making the opera-



Two views of the 3½-ton Mack fighting its way through deep snows in the Allegheny Mountains. The upper illustration shows the great depths of the drifts and how they were cut through by the efficient Pennsylvania highway plows and men. The lower view gives some idea of the depth of snow on the level

SIDE GUIDE & GRIPPER

740-Mile Overland Route of Goodyear Trucks from Akron to Boston



THE southerly route taken by the Goodyear trucks as shown above, and which passes through Pittsburgh, Philadelphia, Trenton and New York City, is much longer than a route from Akron along Lake Erie and thence across New York State to Albany and east through the Berkshire Hills through Worcester to Boston. Still, it had to be followed, even though it costs more to ship goods a greater distance than a shorter distance, because of weak bridges and poor roads.

From North Lima eastward the route is the same as that followed by the Government war trucks now being driven from Detroit to Baltimore, except that the Government trucks leave the route at Gettysburg for Westminster, Md., and thence through to Baltimore. From Rochester, Pa., the route shown is the same as the Lincoln Highway.

From Philadelphia the route leads up through New England as shown, passing through Hartford and Worcester to Boston on the eastward trip with tires to the Boston branch and returning by way of Putnam, Danielson to Goodyear, Conn., where a load of tire fabric is picked up and carried back to the Goodyear factory in Akron. The complete run from end to end is 740 miles long.

tion of any additional trucks it may purchase more successful than ever before.

Saving Time All Important

Of course, the giant pneumatic tires have played a large part in the successful operation of the trucks, in that they have made possible greater speeds than could have been secured with solids. Greater speeds mean a saving in time, which after all is the fundamental principle because of which the transportation of to-day has advanced beyond that of past centuries. Time is becoming more and more important in the transportation of the world's goods. While it is infinitely cheaper, for instance, to ship goods by sailing vessels than by steamships, very few of our large industrial corporations find it worth while to trust the delivery of their goods to the will and caprice of the winds. Instead they prefer to ship by steamer, even though the cost is high, because of the reliability of delivery.

The 3-ton White on its way across country. Note the ordinary cab fitted, the extra tool box and tank on the runningboard. Giant non-skid chains are used on the rear tires, as shown

While of course the present delay in rail shipments is due to unusual congestion, set up by abnormal war conditions, it is the same time element which will be one of the greatest factors in the further development of overland haulage by motor trucks.

The cost per ton delivered will also be of great importance, and the pneumatic tire undoubtedly will prove to be one of the main factors in reducing the cost because of the greater speeds which they make possible and because of the lesser amount of repairs required on account of the greater cushioning which they provide for the truck mechanism.

The 10 months of operation of the Goodyear trucks brought to light many needed improvements not only in the tires undergoing experiment, but also in the trucks themselves. At first there was much tire trouble and the beading was found to be too weak to withstand the loads carried. Many of the tires were removed before their full life had been run and then cut apart to see what effects the wear had produced. Tire sizes and inflation pressures, side wall thicknesses and other points of construction were worked out as a result of the first trips made early last spring. As a result the tires now in use are giving satisfaction, although the experimentation is still being carried on with tires of even larger size, including 48 by 12 on the 5-ton trucks.

Speed and Power Essential

In the trucks a need was found for both speed and power. Due to the many steep ascents and long pulls which had to be encountered in the Pennsylvania mountains, it was found that the engines had to be more ruggedly constructed than those which were giving eminently satisfactory service under average conditions or on city streets. One particular part of the engine which gave considerable trouble at the start was the connecting-rods, which were in one or two cases twisted off and smashed the crankcases when they let go. The engine of the initial truck experienced this trouble and a new engine fitted with heavier connecting-rods has since been in continual service without giving any trouble.

On some of the down grades of considerable length it was found that the engine attained too high a speed when used as a brake and this condition made itself felt especially on the connecting-rods.

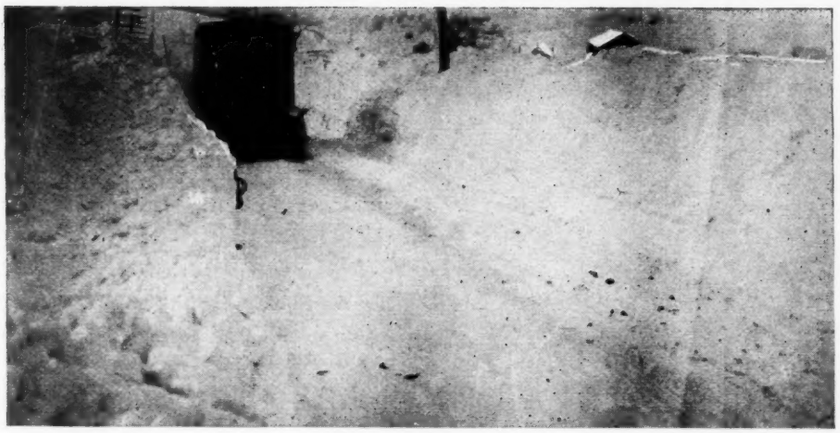
5-Ton Engine in 3-Tonner

The reason why the latest 3-ton addition to the Goodyear fleet is equipped with an engine of a size usually fitted on a 5-ton truck of the same make is to secure greater power and, at the same time, greater speed. The experience of the Goodyear company has been that the average engine fitted in the average 5-ton truck is not sufficiently large to pull a 5-ton load at the speed which pneumatic tires make it possible to run.

The question of the most economical size of load to haul has not been answered as yet, although the Goodyear company is running 1½, 3, 3½ and 5-ton trucks. It is entirely probable that continued experiments with the trucks will make it possible to reduce the sizes of some of the truck parts on account of the use of pneumatic tires, and at the same time carry the full load for which the vehicle was designed. The use of a 5-ton engine in a 3-ton truck fitted with pneumatic tires gives promise of securing some very valuable facts which will bear an important part on the future development of high-speed trucks for overland work.

SCHEDULE OF GOODYEAR TRUCKS FROM AKRON TO BOSTON

READ DOWN ACCORDING TO DAY OF TRIP START							City	TIME Arrive	TIME Leave	Miles	Remarks
Sun.	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Akron	.....	6.00 a. m.		
"	"	"	"	"	"	"	Beaver Falls	3.00 p. m.	3.30 p. m.	90	Fill with gas.
"	"	"	"	"	"	"	Pittsburgh, Pa.	6.30 p. m.	7.00 p. m.	120	
"	"	"	"	"	"	"	Greensburg, Pa.	11.30 p. m.	12.00 p. m.	151	Fill gas. Telegram.
Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Sun.	Bedford, Pa.	10.30 a. m.	10.45 a. m.	216	Fill gas. Telegram.
"	"	"	"	"	"	"	Chambersburg, Pa.	7.00 p. m.	7.30 p. m.	270	Fill gas. Telegram.
"	"	"	"	"	"	"	Gettysburg, Pa.	10.45 p. m.	10.45 p. m.	300	
Tues.	Wed.	Thur.	Fri.	Sat.	Sun.	Mon.	Lancaster, Pa.	5.00 a. m.	5.30 a. m.	356	Fill gas.
"	"	"	"	"	"	"	Philadelphia, Pa.	11.30 a. m.	12.00 a. m.	404	Eat.
"	"	"	"	"	"	"	Trenton, N. J.	3.30 p. m.	4.00 p. m.	443	Fill gas.
"	"	"	"	"	"	"	New York, N. Y.	10.00 p. m.	.....	504	
Wed.	Thur.	Fri.	Sat.	Sun.	Mon.	Tues.	Bridgeport, Conn.	3.30 a. m.	4.00 a. m.	560	Telegram. Fill.
"	"	"	"	"	"	"	Hartford, Conn.	9.00 a. m.	.....	617	
"	"	"	"	"	"	"	Springfield, Mass.	1.00 p. m.	1.30 p. m.	643	Fill gas.
"	"	"	"	"	"	"	Worcester, Mass.	6.00 p. m.	6.30 p. m.	700	Eat. Wire.
"	"	"	"	"	"	"	Boston, Mass.	10.00 p. m.	.....	740	Wire.



A drift as high as the top of the truck. Note that the snow-removal work has been well done so that serious delays are avoided

The Goodyear trucks are now running on a 24-hour per day schedule except for the time required for the men to eat and to fill the fuel and oil tanks of the trucks. This has been made possible by providing two drivers, one of whom sleeps while the other drives. The sleeping compartment runs crosswise of the truck body directly in back of the driver's seat, and is entered through a sliding door in a partition extending to the roof. The sleeping compartment is well ventilated and is provided with a regulation single bedspring and mattress. The floor of the compartment is about 2½ ft. from the floor of the truck body and extends out into the truck body proper. Its rear side is boarded up so that there is no communication between the compartment and the truck body except by getting down onto the driver's seat and walking around to the truck tailgate at the rear. The space beneath the floor of the sleeping compartment is made use of to carry a portion of the load.

Pneumatics Make Sleeping Comfortable

While at first it might seem that sleeping on a 5-ton motor truck would be one of the most uncomfortable things a person could do, especially when the truck was traveling over rough roads, the drivers do not find it impossible because of the use of the large-sized pneumatic tires which make the truck ride almost as easily as some of the heavier makes of passenger cars.

The schedule of the runs in each direction is given on pages 458 and 459, and is laid out for a 4-day run in each direction. The trucks carry finished tires from the Akron factory to the Boston branch and other branches en route as required, and then run from Boston to Goodyear, Conn., where a load of tire fabric is picked up for the return trip to Akron. The drivers do not stay over at the eastern end of the route, but begin the return runs immediately. On arrival at Akron, each driver is given 2 days off before the next trip east is begun.

The route taken by the trucks, as indicated on page 458, is very interesting in that it is by no means the shortest route between Akron and Boston. A much shorter trip could be made by following the lake shore to Buffalo and thence down the Mohawk and Hudson River valleys to Albany, and thence across Massachusetts to Boston. Before the present route through southern Ohio, Pennsylvania and New Jersey was determined upon, the Goodyear company made exhaustive studies of both routes and found that it was not feasible to run 5-ton trucks on the Mohawk and Hudson valley route because of weak bridges.

Poor Bridges Lengthen Route

On this account considerably greater mileage now has to be covered than is necessary, and this, of course, adds to the cost of transporting the material. These conditions bring out very forcibly the great need for suitable motor truck roads, as pointed out time and again in articles appearing in these pages.

In the further development of overland truck haulage at times when the railroads are not so congested as at the present moment, the necessity for running over the shortest distance between any two points will be of paramount importance because of the cost factor, especially when the time element is not the most important consideration. The present route, as shown on page 458, differs from the route originally selected when the service was first established in that it takes a more southerly course between Akron and Youngstown, Ohio.

The latter change was made necessary by trouble encountered on an especially poor stretch of unimproved roadway outside of Akron for a distance of 10 or 15 miles. During rainy periods this road became almost impassable and caused such a large number of delays that it was found advisable to change the route slightly. A stretch of the poor road formerly covered is shown in the illustration appearing at the top of page 460.

SCHEDULE OF GOODYEAR TRUCKS FROM BOSTON TO AKRON

READ DOWN ACCORDING TO DAY OF TRIP START							City	TIME Arrive	TIME Leave	Miles	Remarks
Thur.	Fri.	Sat.	Sun.	Mon.	Tues.	Wed.	Boston, Mass.	Unload	3.00 a. m.	740	
"	"	"	"	"	"	"	Goodyear, Conn.	9.30 a. m.	2.30 p. m.	826	Telegram.
"	"	"	"	"	"	"	Danielson, Conn.	3.00 p. m.	3.30 a. m.	831	Fill.
Fri.	Sat.	Sun.	Mon.	Tues.	Wed.	Thur.	Bridgeport, Conn.	3.00 a. m.	3.30 a. m.	940	Fill. Telegram.
"	"	"	"	"	"	"	New York, N. Y.	9.00 a. m.	.....	996	Fill.
"	"	"	"	"	"	"	New Brunswick	1.00 p. m.	1.30 p. m.	1037	Fill. Telegram.
Sat.	Sun.	Mon.	Tues.	Wed.	Thur.	Fri.	Coatesville, Pa.	12.00 mid.	12.30 a. m.	1133	Fill. Telegram.
"	"	"	"	"	"	"	Fort Louden, Pa.	11.00 a. m.	12.00 a. m.	1250	Fill. Telegram.
"	"	"	"	"	"	"	Bedford, Pa.	5.00 p. m.	5.30 p. m.	1291	Fill.
Sun.	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Greensburg, Pa.	3.00 a. m.	4.00 a. m.	1359	Fill. Telegram.
"	"	"	"	"	"	"	Beaver Falls	10.00 a. m.	10.30 a. m.	1419	Fill. Telegram.
"	"	"	"	"	"	"	Akron, Ohio	10.00 p. m.	.....	1510	Stop.

TYPE OF TELEGRAM

Mr. M. D. Scott, Name of city and date.
Goodyear Tire & Rubber Co., Akron, Ohio.
Arrived Pittsburgh seven thirty p. m. OK
(Signed).....
If for any reason you do not keep up to schedule, report same in daily wire to Mr. Scott.
Scott's telephone, No. 969-W-3. To be used in case of accident or late telegram.

A poor stretch of road 25 miles east of Akron gave much trouble until the route was changed

At first it was believed that it would be impossible to operate the trucks all year around on account of the deep snows encountered on both sides of the Allegheny Mountains as well as in the Ohio flatlands. This difficulty was really overcome to a great extent because of the fact that the route over which the Goodyear trucks are running is in part the same as that selected for the overland drive-aways of government war trucks from Cleveland and points further west, except for a short stretch between Youngstown, Warren and Ravenna, Ohio, as followed by the war trucks and the more southerly route as previously mentioned and taken by the Goodyear trucks. From Beaver Falls east to New York the route is laid over the Lincoln Highway, which passes through Ohio, Pennsylvania and New Jersey. The steepest grades encountered are mostly in the State of Pennsylvania, where the route crosses the Allegheny Mountains. It was at these points that it was expected the greatest difficulty would be encountered. The anticipated trouble was avoided because of the splendid manner in which the Pennsylvania highway authorities kept the route open as a war measure to assist in the delivery of the government war trucks.

Pennsylvania Snow Removed

Pennsylvania took a leading part in the snow-removal work and arranged for new methods, new appliances and new schemes to keep the roads clear. This work was carried out under the drection of W. D. Uhler, chief engineer of the Pennsylvania State Highway System. His department is kept fully informed at all times by the Pittsburgh weather bureau as to weather conditions and approaching storms.

As soon as word was received of the approach of a storm the maintenance division immediately sent notices to the various engineers through whose districts the State highways passed. They in turn arranged to have their men and equipment ready so that no time was lost in fighting the storm. They worked on the principle that it was better to fight the storm while the snow was still falling than to wait until it had become packed hard.

The equipment used consisted of horses and scrapers, motor truck snow plows and a goodly number of able-bodied shovelers. Some of the equipment employed and the manner in which the roads were cleared of snow are shown in several of the accompanying illustrations.

Mechanical equipment was used in every case where possible, and in some instances both day and night shifts were provided in order to have the road cut through heavy drifts before the truck trains arrived.

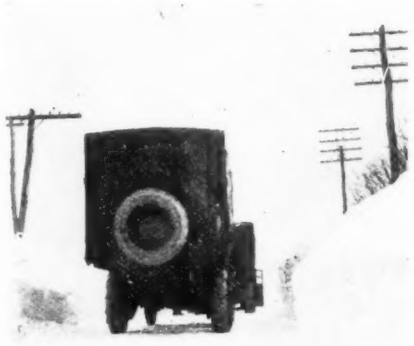
Trucks Equipped with Shovels.

At points in Ohio and New Jersey, where the roads were not so well cleaned, the truck crews oftentmes had to perform some of the snow removal work, and all of the Goodyear vehicles were equipped with shovels and other necessary implements for doing it.

With the advantages of overland motor truck transportation brought home in such a convincing manner this winter, and the work which has already been done toward the removal of snow off the main roads in the rural districts, those owners of trucks who operate them over the roads next winter will undoubtedly find conditions conducive toward more economical operation.

Of course overland haulage during the winter months, especially during the extremely cold periods, is a strenuous service and demands that the greatest possible comforts be given the drivers. The Goodyear company has met these conditions by fitting a closed-in cab on each of its trucks and by providing a heater so that the cab may be kept at a temperature sufficiently high to prevent driving and sleeping from becoming a hardship. It also found it necessary to provide a winch on each of the trucks together with 500 ft. of rope, block and tackles, etc., in order that a mired truck might be extricated with the least difficulty.

The Goodyear company carries full loads both ways on each of its trucks, and this condition will have to be satisfied in the future development of overland hauls for such distances in order that the cost may not become altogether prohibitive. As the work extends to larger and larger fields, it will undoubtedly divide itself up into two main classifications. These include, first, the use of privately owned trucks such as those of the Goodyear company, carrying Goodyear goods, and, second, the employment of commercial vehicles operated by specialists solely in overland haulage.



Over the crest of one of the many mountain grades. Note how the spare tire is carried on the tailgate

The loaded truck reaching the end of the improved road between New Springfield, Ohio, and Beaver Falls, Pa.

Must Prepare Now for After-War Trade

Scarcely Any Portion of World but Will Look to United States—Manufacturers and Industries Must Co-operate for Export Business—Importance of American Merchant Marine Now Coming Into Being

By J. K. Clark

AN ATTEMPT to outline to-day, even in the most general fashion, any phase of international trade after the war is bound to meet with disapproval from more than one quarter. There are those who cry treason whenever a thought is given to any subject except the pursuit proper of the war, while others object to such an attempt as above indicated on the grounds that so many conditions of life and industry after the war are impossible to forecast to-day that all speculation on the subject seems useless.

Those in the first group include many of those who, while sincerely patriotic, refuse to see any need of preparedness up to the very moment when war could no longer be averted, and whose viewpoint has been proved to be shortsighted. The second class of objectors can be answered by pointing to the many new features in industrial and commercial life which the war has brought forth in every country and which are bound to continue after hostilities will have ceased—such as the generally standardized production and distribution of public necessities, the increased centralization of government in each country and the tendency to make every land able to exist on its own native resources as far as possible; finally, to the fact Germany has shown to the world the value of preparing for war in times of peace, and is even now preparing in many respects for the day when international commerce shall once more be resumed. Nor is Germany alone in this class; Great Britain, France and Japan are making keen efforts to be ready for that future time. It would be criminal if America in this regard, too, should lag behind and be required to start future world trade with a handicap.

Expects Closer Combinations

Indications are that standardization of production will by far surpass the state which obtained in our industries four years ago, that quantity manufacture of many articles will be desired because of the new and grander scale on which our factories have learned to work since 1914. With a better regulated financial and transportation system which the war has given us, production and distribution in this country will be much easier, provided there is a sufficiency of capital. Combinations of industrial interests will be looked upon with more favorable eyes by public and government; and industrial policies, planned ahead for considerable periods, will become possible as never before. Very likely, ours will be a much improved merchant marine compared with the days before the war, and it will be the part of the government to so regulate the relations between shipping and seamen's interests as to develop our overseas trade to best advantage.

These conditions will exist no matter how long the war lasts. America will be financially and industrially the strongest country in any case, partly because the United States had to stand three years less of war's burdens than any other nation, partly because its resources are superior.

Turning to the world market, it will be necessary to divide it in a number of regions, which shall be discussed one after the other. They are, beginning on this continent:

Canada; Mexico and Central America; South America; Great Britain; France, Spain and Italy; Germany, Austria-Hungary, Bulgaria and Turkey; the Balkans south of these states; Scandinavia; Holland and Belgium; Russia and Rumania; British Africa; French Africa; India; China; Japan; Australasia.

Canada in Pan-American Group

Canada will be drawn more closely into an official or unofficial Pan-American group of states and will find reciprocal freedom of trade to greater advantage than before the war. With ocean freight rates rising more than railroad rates, and following the universal necessity of economy, it will be easier to deal with the Dominion.

It is fair to assume that the Mexican problem, like so many others, will be solved through the war. In this case the United States is geographically and financially in the best position; already our interests in Mexico are of imposing magnitude and peace will increase rather than decrease them. Considering its natural wealth, Mexico's indebtedness is very small, and as soon as a fairly stable government is developed there, trade will be relatively easy yet profitable. As to Central America, there is every indication of our relations with these states growing more intimate every year.

With an ample merchant marine there should be no difficulty in building up a huge South American trade. This applies especially to those countries which are interested in commerce via the Pacific, where it will take the energies of both Americas to hold their own against keen Japanese competition. Industrial advance in South America will probably reduce the present insularity of the countries and bring Brazil and possibly Peru and Paraguay into closer affiliation with the leading European countries than with North America. One factor which will make South American trade easier, speaking generally, is that the war cannot fail to strengthen that continent's commercial ties with Europe and Asia, develop their industries and make them financially stronger so that in dealing with them long-time credits will not be as necessary as heretofore. Likewise, a great deal of provincialism still existing there will vanish; it will be easier than formerly to do business in the English language.

The trade with Great Britain and Ireland will probably be somewhat lessened after the war. The United Kingdom, if it wishes to re-establish its former dominating position as a creditor nation, must draw as far as possible on its colonies for raw materials and half-finished products. Likewise, if England is to retain the

commercial leadership on the sea, she must lay the greatest possible stress on the lines of communication between the Isles and the British colonies, but also with South America, Russia and the Far East. Naturally, sound business sense will force the English to transport most of their imports on their own merchantmen, of which fewer can then be directed to plying between England and the United States than before the war. Trade with Great Britain will be much more in meat, copper, hides and similar merchandise than in finished products of any sort, and in these goods trade will possibly be smaller than five or ten years ago.

Increased Field in Europe

An increased field of foreign commerce awaits us in Western Europe—France and Spain, as well as Italy. The two countries among these which are now belligerents will naturally prefer, unless price makes it impossible, to deal with America than with Central Europe, or even via Central Europe with the East. Both France and Italy have been less able or forced to develop the enormous automobile industries which have sprung up during the war, here, in England and in Germany; and with their supply of horses diminished and few automobiles emerging from the war capable of further service, they will represent excellent markets, if they are given a fair credit. Spain is in a similar position, because she is removed from the industrial centers of Europe, and having built up a notable merchant marine of her own, will be able to buy here in great quantities and transport her purchases more cheaply than she could by rails over a few hundred miles. Therefore, Spain should offer a splendid market.

Germany and her present allies will probably continue to be more or less closely affiliated in a commercial way, except if the war is continued to the point of their absolute ruin. Unless indications are very misleading, Germany is even now preparing to make up for the losses in her merchant marine, and is said to have built many vessels already. If so, she will commence heavy buying, not only of raw materials, but also of all such finished products which the world market affords at relatively low price—for instance American automobiles and machinery—so as to release the greatest possible proportion of her own production for the markets in Eastern Europe and Western Asia, South America and the Far East. All the sentiment in the world will not be able to prevent this; for Germany is in a favorable position to pursue such a policy, due to her having husbanded her gold during the war.

Might Find German Market

As maximum sale and production is the principal means whereby we may best hope to assume and maintain a leading position in any special world market, the United States automobile industry is likely to engage in such a trade, even if it be to Germany's advantage temporarily; for the latter country will, based upon developments there during the war, so organize her finance as to release a maximum of credit for foreign trade, basing internal commerce principally upon government regulation and "clearing-housing" of materials and good-will. Austria-Hungary will, very likely, be very much under Germany's control; while Bulgaria is likely to try and retain as much independence as possible by keeping in touch with the international, and not only the German market. With Turkey, there is also a possibility of coming to commercial arrangements in spite of German influence.

It is a safe assumption that the southern Balkan states, Serbia, Montenegro, Albania and Greece, will be in a state of full independence after the war, and, offering free access to trade from land and sea, the law of supply and demand will hold valid there in a broad way. Each of these countries will, as Asia is invaded from East and West, be transformed from a purely agricultural condition to a state of budding industrialism, offering a fruitful market to the foreign producers of divers modern machinery. In a section as mountainous as the Balkans and now deprived to a large extent of its former means of animal transportation, there will be a strong demand for motor vehicles, especially since the railroads which these countries require for their development cannot be constructed as rapidly as needed. Of course, business there will call for long-term credits; but with a certain amount of business regulation by representative governments there should be no reason why such credits could not be extended.

There still remain to be considered the Northeastern countries of Europe. The Scandinavian countries, Denmark, Sweden and Norway, have been forced by the war to form a kind of entente cordiale, which most likely will survive the war in some form or other for the sake of economic benefits. Trading arrangements and conditions in these countries will be very much alike. All three will, provided they continue to remain neutral to the end, be as progressive and as prosperous as any in Europe, and in need of, as well as able to buy, plenty of modern equipment of every sort.

Holland Buys Diplomatically

Holland, while economically as strong as the Scandinavian countries, will have to maintain well-balanced business relations with both sides of the present belligerents, due to her geographical position. She will always require many products she herself is unable to turn out; but being forced to keep on the best possible terms with everybody, her buying will not be guided by purely business considerations alone. The chances are, however, that general satisfaction will best be maintained by her buying certain raw materials and finished products from one country and others from another—say, cotton, wheat and machinery in England and America; and coal and its divers products, sugar and rails in Germany. These examples are, of course, taken rather at random and only for purposes of illustration.

Belgium, even if she should desire to maintain a similar basis of free or equal trading, is bound by such strong ties to America and her allies that her business will be principally with these countries. With a seaboard of her own, and at least Great Britain backing such a policy, she will probably keep as well separated from Germany as any country in Europe. Belgium is a prosperous country under normal conditions, which the peace arrangements undoubtedly will restore, and the work of reconstruction will create a manifold market there, in which American trade is bound to share to a very large extent.

Russia at this moment is rather an unknown quantity; but order is bound to return, and with order must come a period of unprecedented advance. Already Russia is preparing to develop an efficient railroad net. The land is being so redistributed as to make possible profitable farming by its small owners who will be ready to invest in all modern devices rendering their lives broader and more enjoyable. Indeed, before the war, the Russian masses were highly conservative; but even before the revolution, war itself, and the contact with Germany and her up-to-date methods, had served to educate the Russians to the meaning of the twentieth century, technically speaking. There will be a wonderful market there for those who understand conditions and have foresight

enough to develop the correct ways and means of dealing with them.

As for Rumania, she will be economically an appendage, either of Russia or of Germany. A great deal of her needs will come from the latter country, but as Rumania possesses a coast in the Black Sea (which body of water will be brought to greater importance by Russia's becoming a commercial nation), she will have an opportunity of ample overseas trade.

Africa Expanding Market

The African colonies of Great Britain and France will very likely attain a somewhat greater liberty than heretofore, and a great many requirements of their further evolution will be supplied by the United States. The colonies will *have* to be developed as rapidly as possible, and France and England will welcome any help from without that renders them powerful markets within the shortest possible time. To reach this point, the colonies will have to be possessed of modern industries, carried on by modern machinery, which America can cheaply and rapidly supply.

With the minimum of shipping the world will have ready when the war ends, Australia will have to deal with her nearest neighbors as far as possible—and here is the chance for America and Canada. There should be opportunity for similar agreements between the United States on one hand and each of these colonies on the other; and to a certain extent England will acquiesce in, if not support, such a policy; at least for a limited length of time.

Finally, there are Japan and China. The war has strengthened very much the ties which bind the latter to the former and, while the once open door may still be ajar, it will take the co-operation of the Western powers to keep it so. Japan is to-day in a position to depend on herself, or almost wholly so, and she is rapidly developing Chinese resources which are of service in this respect, and of course tends to monopolize Chinese resources as far as possible. Needless to say, China's development must soon reach a point where, in consciousness of her own advantage, she will demand and receive in a fair measure the blessing of the open door, which has been curtailed more and more since the day Japan entered the war. When China reaches this stage the nearest hand she will be able to grasp will be that of America; and it is to prepare for that time to which our efforts must be directed.

Undoubtedly, after gaging the divers conditions, opportunities and peoples of the countries of the world, it must be granted by even our ultra patriots and commercial pacifists that we must give some thought to the methods of the near future. Attention has been called by several writers, especially by former Ambassador Gerard, to Germany's after-war plans. They include industrial combinations for collective buying and selling abroad, and it goes without saying that unless we want to be the losers Greek must meet Greek. Individual firms must deal with other countries through government-controlled agencies for buying and selling, and the hand of the government will insure the general public against ill use of their combinations by such firms.

Centralize Exports

For instance, all automobile manufacturers desiring to export to France should act through a central agency and exhibition in Paris, with possible branches in other large cities, familiarizing the French public with our wares. If Frenchmen desire to buy here direct they will do so through a similarly organized "purchasing embassy," whereby neither party is at an advantage or disadvantage by its or the other's monopoly.

It is for developments along these lines that we must now begin to prepare, lest they are to surprise us when they come about. The manufacturing, distributing and governmental influences should now begin to work hand in hand toward the planning of efficient organizations whereby an ever greater world trade can be built up.

Automotive Design and Transportation as Developed by the War

(*Continued from page* 455)

dency toward improvement of the front compartment, a thing which has been fought for in some quarters very strongly in the past three years. Where there has been additional space gained, this has usually gone into the front compartment rather than the rear. The remarks which were made a year ago regarding the front compartments, however, still hold good to a large extent. The driver's seat is generally comfortable after he has seated himself, but while entering and leaving the seat the driver is apt to be uncomfortable.

The color situation is a little better now than it was a year ago, although it is not so easy to secure the desired pigments even now. There are a number of brighter colors now in evidence, showing the tendency toward individuality, particularly among concerns which make in the neighborhood of ten to fifteen cars a day.

One of the tendencies which may be predicted in body design is that the cars of the future, at least of the touring variety, will be of the two, four or six-passenger type. This is highly desirable from the standpoint of beauty of outline, as it gives a car which does not have to have the rather unsightly wheel housings. A two, four or six-passenger body can be swung between the rear wheels, giving a narrow gas line.

Manufacturers will do very well to put out a few special bodies wisely scattered through the country on their stock chassis. There is always a market for these cars that act as potential advertising for the company and can always be sold at a figure leaving a handsome profit. The dealer welcomes a car of this kind for his show room, and it has been the experience of companies that have made these cars that there is always a great amount of competition between the dealers as to who is to be the one to get the special body.

There is still room for improvement in door fitting, judging from an inspection of the cars on the floors of the show. This same condition held true last year. Doors will be tight on one side of the body and loose on the other. The shape of the backs of the seats can also be further improved, as the bulge of the back should fit the body. With respect to closed cars, and particularly the convertible type, we seem to be in an era of uncertainty. Manufacturers do not know whether the majority of buyers want a permanent pillar or a removable pillar in the sides of the touring sedan models. This popular car has had a large sale this season and will continue to have equal success next year, according to present indications. There has been a considerable amount of argument in favor of the permanent pillar, in that it can be made lighter and at the same time more substantial. This seems to be a matter for education on the part of the purchaser as well as development by the manufacturer.

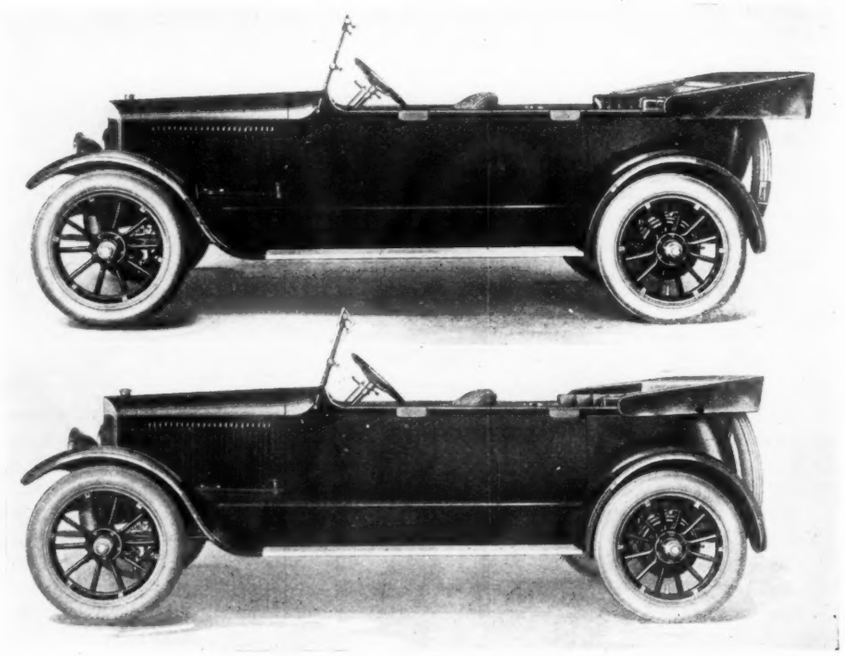
Summing up the entire situation, it may be said that we have entered upon a new era. The improvements in design up to the present will serve as a valuable guide in the new period which the war has brought on. The car which will carry its load with the least surplus weight, with good acceleration ability, without undue length, with an engine of ample but not excessive displacement, and which will give the utmost in performance and comfort for the money expended will be the one which will best meet the new conditions.

The Stanley Steamer in New Form

Fitted with a Body of Modern Design of Either Four or Seven Passenger Type—Piping System Greatly Simplified

A NUMBER of detail changes have been made in the Stanley steam car for this year which have made it a considerably improved product. Probably the most radical changes are in the body and in the piping system. The body has been brought thoroughly up to date and is now an example of the straight line type, designed by George J. Mercer, who is well known as a contributor to AUTOMOTIVE INDUSTRIES. The cowl has been raised, as has the hood, making the radiator higher. The V shape at the front of the radiator has been made sharper so that it now has what is known as the Mercedes line. The remaining part of the car is of the straight sided, flat, beveled edge type with square corners on the doors, full crowned fenders and a cowl board for gages, speedometer, etc. The windshield is sloping.

Instead of making the car in three-, five- and seven-passenger styles as previously, only two bodies are offered now, the seven passenger and a four passenger. There is no roadster model and no five-passenger model. The four-passenger model has both front and rear doors and where the back has been moved up to make it close-coupled, a sweep has been given the back, giving a modified turtle back.



Seven passenger and four passenger Stanley cars

From the owner's standpoint probably the biggest change is in the electric device for heating and igniting the pilot vaporizer. This operation was formerly accomplished by means of a Prest-O-Lite tank. This has been done away with, however, and current is now furnished by a Willard storage battery to a resistance coil controlled by a button. The arrangement is such that the current cuts itself out after its mission has been accomplished. With this modification of the burner it is now possible to use kerosene in the pilot. If desired, however, gasoline can also be used or a mixture of the two fuels. Pilot burner and vaporizer are now a unit and can be easily removed at any time without disturbing the burner.

Piping System Redesigned

From an engineering standpoint probably the cleaning up of the chassis is the most noticeable improvement in this year's Stanley car. By redesigning the piping system it has been possible to reduce the total length of piping by about 60 per cent. The piping itself is now also standardized as to size and fitting and the units themselves have been made much more accessible.

In the fuel line the vaporizer coil has been omitted and the so-called master valve as well. The fuel line is controlled by the main burner valve on the instrument board, which not only does the work of the fuel valve, but also incorporates the work of the master valve. The pressure tanks on the fuel system have been moved forward and are now in front of the pump box. This cuts out a complete return piping system to these tanks and shortens the connection very considerably.

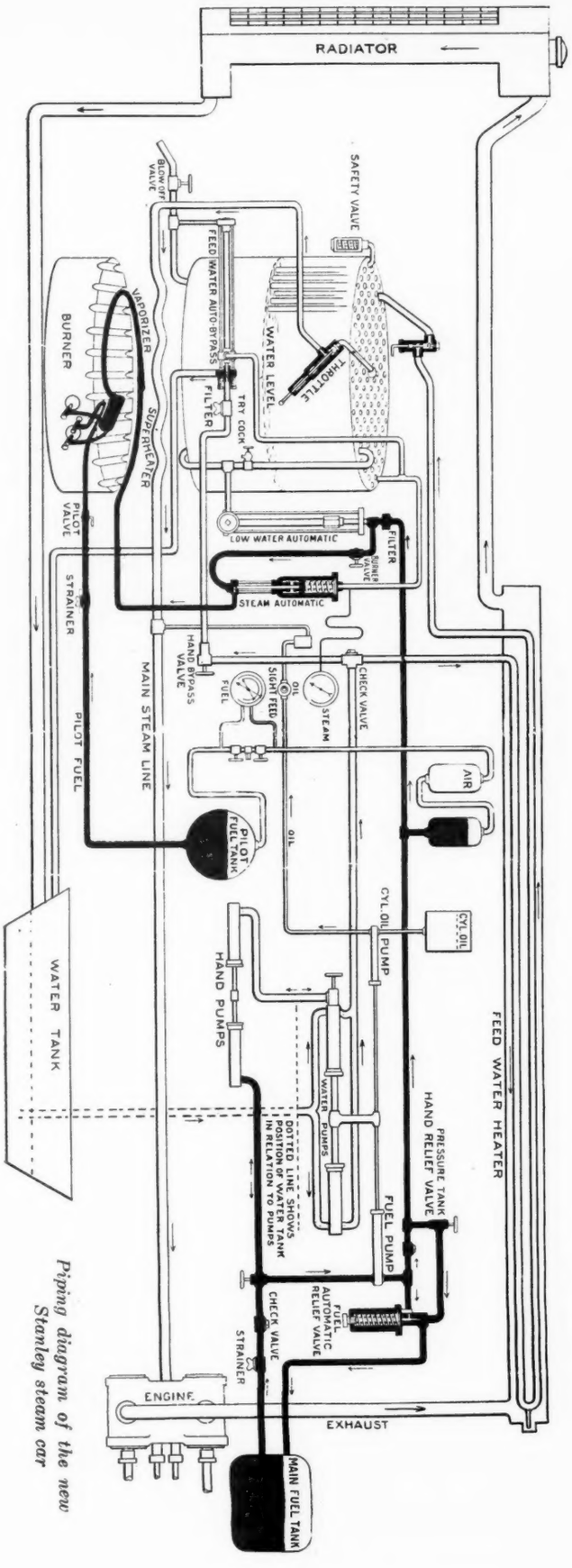
In the water system the piping has been standardized as to size and is now 7/16 in. throughout. The front and rear pumps are now interchangeable and the system has been improved so that any sound or water hammer is impossible regardless of the car speed. The pumps are connected so that they now work together instead of independently as before, and this has simplified the water line considerably. The three-tube water indicator formerly employed has been replaced by one of new design of the float type, which always indicates the correct level of the water whether the car is under steam or not.

The piping diagram herewith shows the new system completely. It should be pointed out that this is in diagrammatic form and that on the car the units are somewhat differently located than in the illustration. For instance, the water tank is right beside the power pump, instead of below, as indicated in the diagram. The rear by-pass valve has been eliminated, and both the rear and front water pumps are controlled automatically, so the driver no longer needs to use a rear by-pass valve as heretofore.

Very few changes have been made in the steam system. One important change, however, is in the super-heater, which is now arranged in a series of parallel loops instead of a coil, as heretofore, and the steam on leaving the super-heater goes direct to the engine instead of passing up through the boiler. With this arrangement a greatly improved job is obtained, from an accessibility standpoint. The whole super-heating system can be taken out by removing three bolts, and without disturbing the burner. The super-heating tubes, furthermore, are made of an improved heat resisting metal, that is practically unaffected by the continued high temperature under which they operate.

Fuel System Rearranged

The fuel system has been greatly simplified by moving the pressure tank up to the pump. This places the units of this system in the most direct arrangement and the air pump line to the pressure tank is only 18 in. long instead of being the entire length of the chassis. The fuel automatic is under the floor in the rear, so that the return line from the automatic can be very short. The fuel pump is practically unchanged,



Piping diagram of the new Stanley steam car

and the fuel flows straight to the burner, passing the fuel automatic, pressure tanks, low water automatic, and steam automatic on the way. It enters the vaporizer on the rear end of the boiler and from it passes to the burner. The pilot fuel system is now just one straight tube from the pilot tank to the pilot burner without interruption and with but one valve. There is a loop in this pilot line directly over the pilot burner, which acts as a small vaporizer.

Specifications of the car are given in the accompanying table:

Car	Price
Seven-passenger touring car	$2,600.00
Four-passenger	2,550.00
Chassis only	2,225.00

MECHANICAL SPECIFICATION TABLE

Boiler	Stanley fire-tube type welded construction, 23 in. diameter.
Burner	Drilled type, burning kerosene or gasoline without alteration.
Pilot	Kerosene or gasoline with small tank of four gallons capacity.
Engine	Two cylinder, 4 by 5 slide-valve type double acting and geared direct in the differential ring gear.
Water tank	24 gallons capacity.
Water mileage	150 to 250.
Pump	Driven from rear axle at one-quarter engine speed.
Light	Electric throughout with Willard battery and Apple electric generator.
Steering gear	Warner.
Wheels	34 by 4 artillery type cord.
Tires	35 by 4½ straight side.
Body	Aluminum.
Color	Royal green.
Fuel tank	20 gallons capacity.
Brakes on rear wheels.	
Front axle	Timken.
Rear axle	Stanley, with Timken and S.K.F. bearings.
Wheelbase	130 in.

Analysis of Labor Motives

EIGHT human instincts must be reckoned with in handling the labor problems of a factory, according to the views expressed by industrial relations experts at a recent conference in the Brooklyn, N. Y., Academy of Music. The experience of personnel managers in the past few years shows that it is old-fashioned and unintelligent to assume that labor is interested only in the dollar and cents side of its work, although that is a fundamental consideration.

The chief influencing factors in the life and work of the employee were outlined as follows:

1. Parental Instinct.
2. Sexual Instinct.
3. Workmanship Instinct.
4. Possessive Instinct.
5. Aggressive Instinct.
6. Submissive Instinct.
7. Herd Instinct.
8. Instinct of Curiosity.

The possessive, parental, and sex instincts may be considered as those most closely related to the wage problem. Every worker wants more money for himself, so that he may establish a home, and so that he may bring up a family. Where the wage fails to satisfy, at least in a measure, these instincts there is sure to be discontent and lack of co-operation. A man's interest in his family will also make him seek a community where housing and social conditions are good, in preference to a community which is deficient in that respect, even though the wages at the latter place are somewhat higher.

The herd instinct, better known among laborers as "solidarity," is an increasingly important factor in the labor problem. It is one of the most potent forces in unionism.

The aggressive instinct and the instinct of curiosity are two forces that a capable personnel manager will be able to turn to great advantage, both from the standpoint of the organization and the workers themselves. A laborer who has curiosity is interested in his work, and one who is aggressive is capable of a high degree of production if he is placed in some position where his powers can be exercised. The so-called "agitator" can usually be an asset to the organization if the employment department is well-managed.

On the other hand, the submissive instinct is probably the most useful of all, viewed from the angle of large scale production. The rank and file of workers take what their jobs bring to them, through inertia. Keeping a working force enthusiastic and interested in the organization is a big task, but the routine of the industry is greatly facilitated because the average worker takes orders unhesitatingly.

MANUFACTURERS' MERCHANDISING

The Farm Tractor Instruction Book

It Must Be Illustrated with Photographic Reproductions, Should Be Pocket Size and Should Have Work-Proof Covers—Should Tell How to Make Tractor Repairs

Part II

LAST week we told how H. L. Thomson advised tractor makers to deliver their instruction books to the farmer. This week we give Mr. Thomson's practical suggestions on the writing of an instruction book.

Covers—A poor cover is the worst possible advertisement to a tractor instruction book. When the farmer needs it his hands are dirty. They have grease on them. They may be wet with water or mud. If the cover is poor paper it just melts out of existence and is gone. Make the cover oil proof and water proof.

Size—There is nothing so good as a pocket size book. It should never be of that size that it has to be folded to be carried in the standard size of pocket.

Simple Language—Too many books are written as one engineer would talk to another engineer. They talk about mean effective pressure, volumetric efficiency and bearing tolerances or piston limits, that cannot be understood by the user. Such language turns the user away from the book rather than magnetizing him.

The Simple Story—Do not use blueprints. The farmer never made one in his life and cannot read them. Use X-ray wash drawings instead. Get a sketch artist and make perspective drawings of parts and systems. Do not spend thousands of dollars on good engineers and then not hundreds on good illustrations for an instruction book.

Oiling Charts—Use large charts showing every bearing and tell in plain figures how often each should be oiled. Have arrows pointing to the bearings and print the period of time (in colored ink) when these parts should receive attention.

The True Story—DO NOT CAMOUFLAGE. Do not be so foolish as to write your book as if nothing would ever go wrong with your tractor. That is just the way to get in bad with your buyers. Parts of your tractor and every other tractor will go wrong. If you attempt to deny it you are like an ostrich hiding its head in the sand, vainly imagining that because it cannot see that it in turn cannot be seen.

Major Repairs—Tell in the book how to make major repairs on your tractor. Do not forget that with the tractor the farmer must be the expert. When a tractor goes wrong you cannot drive it to the nearest garage, as with a motor car or motor truck. No. You must tell the farmer how to do the job. It might be how to take up a lower connecting rod bearing. Give him every step in the process. Number them 1, 2, 3, etc. Tell him how to scrape a bearing. It is not enough to say: "Take out the crankshaft and with the ordinary scraper smoothe the bearing until it is round and fits the shaft." That is no good at all. Illustrate how the scraper should be held. Tell how to mark the bushing to show where scraping must be done. Tell every step in the job. There may be ten other important jobs on your tractor that must be repaired. Take ten or twenty pages, if necessary, to tell how these are done. Every dollar you put into such may save you thousands of dollars in service later.

Book Arrangement—So often the tractor instruction book is poorly arranged. Many have no logical arrangement. Decide on some logical order of taking up the entire tractor. You may first take up the motor, then the transmission system, and lastly the chassis, or you may use other sequence, but get some order and adhere to it.

Hitches—Every instruction book should carry instruction with good illustrations on hitches. Illustrate this fully, and whatever instruction you have regarding the hitch print it right below the illustrations, so that it will all be easy to follow.

Laying Out Fields—The book should contain instructions on how to lay out field for tractor plowing and cultivation.

Timing Charts—There should be timing charts with the complete wiring system. If possible, lay out these charts as simply as possible. It is not a bad idea to place the chassis in dotted lines back of the instruction diagram, so that it is easier to follow the circuits. Place the complete system in one chart, if possible. Carburetion charts explaining how to make carbureter adjustments should be included.

WE take the liberty of adding one suggestion to the excellent ones given by Mr. Thomson. Perhaps the first is that the book should be psychological in its arrangement. That is easy. Here is one of the first laws of psychology:

GO FROM THE WHOLE TO THE PARTS.

That means give a general conception of the entire oiling system of the engine, for example, before you attempt to tell all about some little detail of that system.

Do not try to explain the pressure control valve in the oiling system before you have explained that it is a full pressure system in which an oil pump delivers oil under pressure to the main crankshaft bearings, and that from these the oil enters the hollow crankshaft and is delivered by centrifugal force into the wrist pins and thence is sent by pressure up the connecting rods to the wrist pins, with a safety valve to bypass some oil when the pressure rises too high. With a general conception given, then pass to details.

This means going from the whole to the parts.

Going from generals to particulars means the same.

Problems of the Hotchkiss Drive

Side-Sway Has Been Practically Eliminated by the Use of Flat Semi-Elliptic Springs—Brake Linkages Are Causing Some Trouble Owing to Change in the Center of Oscillation

By J. Edward Schipper

IN spite of the fact that the Hotchkiss drive continues to grow in popularity, and is proving, in the main, a very satisfactory arrangement, both from the standpoint of weight saving and that of satisfactory service, there are certain problems connected with it that remain to be solved. During the first two years the drive was in general use the matter of side-sway was probably the most important difficulty which had to be dealt with, but this has been solved to a large degree on present installations.

The side-sway difficulty has been overcome chiefly by the use of semi-elliptic rear springs which are almost flat when in the normal riding position. Springs of this type are relatively rigid sideways and interpose a considerable resistance to periodic side-sway. It is, of course, necessary to back up the springs by a substantial structure at the rear of the frame. This is done by thoroughly bracing that portion of the frame which extends back of the rear cross member.

It must be remembered that the stresses imparted by the car in its tendency toward side-sway are all transmitted to the rear end of the frame, and, as the rear cross member is some distance from the rear, it is quite certain that a weaving action will take place unless there are bracketing members to take up these stresses. A crossbar placed as closely as possible to the rear end of the frame is one of the best means of securing rigidity at this point. Crossbars are more serviceable in this connection than gusset plates, which are susceptible to rivet troubles.

Difficulties With Brake Connections

Difficulties with brake connections are always encountered with the Hotchkiss drive. This is only natural, considering that the center of oscillation shifts constantly, owing to the flattening and elongation of the spring and to variations of braking torque in connection with the reaction of the spring. When the brakes are tightened on the rear wheel drums there is a tendency for the wheel to carry the axle housing around with it. Thus, if brake levers on the rear axle extend upward, there is a tendency to shorten the brake rod length, as the housing will move slightly, owing to the flexure of the rear springs. On the other hand, if the car is moving backward and the brake is applied, there is a tendency for the brake rods to lengthen. Should the brake levers on the rear axle extend downward, the above conditions are reversed for both forward and backward travel.

If the centers of oscillation could be fixed so that changes due to the flexure of the springs could be compensated for in the braking mechanism, no difficulty would result from these conditions. But since it is impossible to fix accurately the center of oscillation, it is necessary to determine the mean center and then to work from this point. An example of what has been done in this respect is furnished by Leroy V. Cram, chief engineer of the Empire Automobile Company, who states:

"After carefully determining the approximate mean center of oscillation, our results were checked by laboratory methods and were corrected slightly. Then, because of the tendency of the brake rod to change length we made up our mind that for maximum safety one set of brake levers should extend up from the axle and the other set down. We, therefore, extended our service brake levers down, that being the correct position for 90 per cent of the braking, and the emergency brake levers up, to take care of the exceptional case."

Variation in Braking Power

This does not mean that with this installation the service brake is ineffective when the car is backing up, or that the emergency brake lever does not function when the car is going forward. It simply means that the service brake is more effective in going forward and the emergency in going backward. In either direction it will skid the wheels upon gravel roads, but it takes less pressure with either brake in one direction than it does in the other.

One of the difficulties that engineers have experienced in connection with the Hotchkiss drive, and which up to now has not been entirely eliminated, is wear of the slip spline on the propeller shaft. The amount of slippage at this point normally amounts to about ½ in., but change of propeller shaft length under heavy loads when there is a very severe pressure on the spline causes wear to be noticed at this point at the end of several thousand miles of driving. Probably the remedy is in the use of a type of joint which does away with the necessity for a splined shaft at this point.

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New Aircraft Engine Oiling System

AN arrangement of oil pumps for aircraft engines has been patented in England by A. A. Remington of the Wolseley Motor Car Co. which makes it unnecessary to slope the oil base toward the center so that this will always be the lowest point of the base no matter how much the airplane is tilted. Remington provides two return pumps for the oil, one located at each end of the sump and having its inlet in a depression therein. So long as the engine remains substantially level, both pumps will return the oil accumulating in the base of the engine to the oil reservoir, but if the engine is tilted appreciably, so that the inlet of one of the pumps is above the oil level, all of the oil will be returned by the other pump, and for this reason both return pumps are made of sufficient quality to handle the entire oil circulation. The oil feed pump may be located in a pocket of the middle of the sump.

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THE United States produces 65 per cent of the world's petroleum output. The United States, Russia and Mexico together in normal times produced nearly 90 per cent. The Russian and Mexican oils, however, to a large extent, are not of the class known as "refinable crude petroleum," hence for the production of petrol and naphtha by ordinary refinery methods oil from the United States must be depended upon.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

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Tractor Development

IT is a matter of congratulation that the tractor industry has made such signal progress within the past year. So far as engineering trend in tractor design is concerned, it is now certain what channels of development will be followed. The more general use of forged, heat-treated gears; the introduction of pressed steel frames; broader use of ball and roller bearings; weight reduction in wheels and gearsets and better engines will make a higher standard of tractor efficiency possible.

The rumors concerning a standardized Liberty Government tractor aroused the tractor makers. Not that they might in any way be opposed to tractor standardization being carried further than it has been carried this year, but the opposition has largely been because any such announcement would tend to delay buying by private purchasers, many farmers deciding to wait until they had seen the new job. The emphatic denial that such a tractor is even being considered by the Government has clarified the tractor sky a good deal.

Good progress has been made with tractor standards in S. A. E. work in the past year, though as compared with what has been done in aviation standards the progress has been very slow. The cases are different. Aviation has but one customer, and that the Government, whereas every one of the 6,000,000 farmers of the country is a possible tractor customer. It is not logical to draw comparisons between the two.

The Fuel Oil Shortage

HARDLY had we passed the critical point in the coal shortage when the country was prepared for another shortage which, if it should materialize, might equally hamper our industries. The first intimation of the impending shortage in fuel oil in the eastern parts of the country was given in an announcement issued last week by M. L. Requa, in charge of the oil division of the Fuel Administration.

As in the case of coal, there is no pronounced shortage at the source, the oil fields of Oklahoma, Texas and Mexico. But the means of transportation have been curtailed, while, on the other hand, the consumption in certain lines has greatly increased. Fuel oil, it may be explained, is a distillation product of crude oil, heavier and less volatile than lamp oil. In recent years much of the fuel oil has been converted into motor oil or gasoline by the cracking process, which, of course, has greatly decreased the available supply of fuel oil. Fuel oil is used very extensively under the boilers of naval vessels, and as a result of the present activities of our fleet, both at home and in European waters, the demand from this field has greatly increased. Further, fuel oil is used for enriching so-called water gas, largely used in industrial processes, as a fuel in stationary steam-power plants and as a fuel for certain classes of internal combustion engines. In the heat treatment of steel, which is now being carried on on an unprecedented scale, owing to the manufacture of munitions in thousands of plants throughout the country, fuel oil is largely employed.

It seems that what led directly to the shortage was the commandeering of a number of tank steamers which plied between Gulf ports and Atlantic Coast refinery districts. There seems little chance of making up for this by increasing railroad haulage of crude oil, as to offset the loss in tanker tonnage would require tens of thousands of tank cars, not to mention the number of locomotives required and the congestion already existing on practically all railroad lines that would come in question. Perhaps, however, when our shipbuilding program gets into full swing and vessels are being turned out according to schedule, the tankers now commandeered will be released and additional ones placed in service between Atlantic and Gulf ports so that there may be no need for shut-downs of industrial or public service plants on account of lack of liquid fuel.

That the situation is serious is shown by an official statement that only five classes of the twelve established under the priority regulations are being supplied at present, and a report from Schenectady last week intimated that the General Electric Co., which is largely engaged on war work, might have to shut down for lack of fuel oil.

Assembly Jobs Must Be Well Balanced

THE practice of assembling from stock parts purchased of outside manufacturers is now so common in the motor truck industry that the quality of motor truck service in general depends to a great extent upon the care with which these components are selected. If a truck is built complete in one plant, every part, naturally, is designed to harmonize with every other part as regards its ability to transmit power or to support loads, and the complete truck generally forms a well-proportioned unit. Starting with the engine as a basis, the clutch is made of just sufficient capacity to transmit the maximum engine power, with perhaps a slight reserve; the change gear is designed to take care of the same amount of power, while in the design of the rear axle account is taken not only of the maximum engine output but of the lowest reduction in the gearbox as well, and the proportions of such parts as the axle shafts will depend also upon the final reduction ratio.

Generally, when an assembled truck is first evolved the various components also are fairly well balanced. Not only is it to the assembler's advantage to use parts of as nearly as possible the same capacity, because it results in a better-performing truck, but the parts manufacturers are interested to have their parts stand up and they will see to it that these parts are not grossly misapplied. Sometimes, however, it is difficult to secure exactly the right parts, especially in times like the present, when the truck industry is booming.

Engine Protected

Probably of all the manufacturers supplying parts for motor trucks, the engine maker is concerned least with a judicious choice of components. If the engine selected is larger than necessary it will simply run light most of the time, which would lengthen its life, though it might lower its fuel economy. On the other hand, if the engine is somewhat small—well, it cannot be made to give more than so much power, and since truck engines have their bearings and other vital parts proportioned for heavy duty, they cannot be injured by being run more or less continually under full load. On the other hand, the clutch, transmission and rear axle all must take the load which the engine is capable of delivering, and if their carrying capacity is below that of the engine, trouble is sure to ensue.

Perhaps no part of a truck is so apt to suffer as the rear axle, if the design is not well balanced. There is no truck axle that has a very high factor of safety, because an axle stronger than need be tends to make the truck heavy and sluggish and to increase tire wear. The best axle is one which has just a small excess of strength over the maximum stress that is likely to even come upon it.

Now there are certain changes which can be made in the design of a truck which will raise this maximum possible stress. They are:

An increase in the engine size; an increase in the low gear reduction ratio; an increase in the rear axle reduction ratio.

It is evident that each of these changes involves an increase in the maximum torque which can be impressed on the axle shafts. No reliance can be placed on the limited coefficient of adhesion causing the wheels to slip, as the use of grips and non-skid chains practically eliminates this safeguard.

Higher Low-Gear Ratios

We understand that some trouble has been caused recently by the introduction of transmissions with extra large low speed reductions. Truck manufacturers have long been calling for such transmissions, but until recently the call had not been heeded by the transmission manufacturers. It is evident that an engine of given torque characteristics can impress 20 per cent more torque on a rear axle if the low gear reduction is five than if it is four, and this may easily be the difference between an axle that will stand up and one that will give trouble.

Heretofore it has been the custom of axle manufacturers to specify the maximum A.L.A.M. horsepower and the maximum weight for which an axle was designed. Low-gear reduction and rear axle ratio have been considered as practically constant for trucks of given capacities, but recent developments have made these assumptions unsafe. It is therefore not unlikely that axle manufacturers will introduce a load figure or capacity figure which will be the quotient obtained by multiplying together the cubic inches engine displacement, the low gear ratio and the rear axle ratio. If this were done and axle makers strictly adhered to the rule of not supplying axles of a given capacity for trucks calling for a higher capacity, axle trouble would be greatly reduced.

Meanwhile it would be well for assemblers to bear in mind that in a well-balanced truck every part is of just sufficient capacity to do its work and no more, and if this balance is disturbed by adopting a larger engine, for instance, the other parts will suffer. There has been a well-defined tendency among assemblers to use engines more powerful than necessary, as it permits of making impressive demonstrations and helps to effect sales. However, to sell the trucks is not the whole problem; unless trucks once sold "stay sold," impressive demonstrations will soon be of little avail, and the first step toward making them "stay sold" is to eliminate weak links and trouble breeders at the outset.

AMONG the many other industries stimulated by the war is that of growing castor beans. Castor oil is generally admitted to be the best lubricant for aircraft engines, but is little used at present because of its scarcity. During the coming spring large areas in several Southern States will be planted to castor beans, at the instigation of the Chief Signal Officer. The price of castor oil has gone up constantly since the outbreak of war, and as long as the war lasts the price will be at least maintained. Even in peace times about a million bushels of the beans are needed in this country annually.

□ Latest News of the

Pennsylvania Buys 40 Tractors

Agriculture Department Will Loan Them to Farmers at Minimum Charge

HARRISBURG, PA., Feb. 27—Secretary of Agriculture Charles E. Patton has completed arrangements to place forty or more farm tractors at the disposal of the Pennsylvania farmers.

No department funds are available for the purchase of tractors, but Secretary Patton had little trouble in securing the pledge of co-operation from the Committee on Public Safety and Defense, which is headed by Governor Brumbaugh and is composed of three other State officials. This commission has had at its disposal for war purposes $2,000,000 and a liberal amount is to be allowed for tractor purchases.

Negotiations are now on with tractor manufacturers for the purchase of forty tractors. Eight or ten different makes of tractors will be purchased and these will be apportioned to different sections of the State. The next task will be to secure eighty or more competent tractor operators, for each machine will be equipped with lights and crew and kept going 20 hr. a day.

Will Train Operators

When the tractors are purchased and the operators secured, one machine of each make selected will be sent to the State Agricultural College and the operators will be sent there for a week or 10 days for instructions from factory representatives and engineers. Eighty first class operators and mechanics are expected to come forth from that school.

Efforts will be made to have organizations of farmers in one county arrange to use the tractors and a regular schedule of work will be made up in each territory. One farmer will contract for 40 acres, another for 50 and enough will be signed to contracts to make it worth while to establish the tractors in that section of country. When all the assignments are made up, a regular tour will be outlined, enough machines will be assigned to the work, and it will be tackled by experienced men. The farmer furnishes the labor.

The farmer will sign a contract specifying how many acres he desires to have plowed and agreeing to pay the charges which will be fixed for plowing and fitting work. The basis for these charges will be fixed by the acre. They will include the cost of fuel, operator and oil, the idea of the State being to furnish the tractor at the very lowest cost to the farmer, with the least amount of trouble and care on his part.

The tractor will carry its own plows, but any other machinery, such as harrows or disks, will have to be supplied by the farmer. It is likely that the charge for plowing will be between $2 and $3 an acre and the charge for fitting the land about 80 cents or $1 an acre.

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Suspend Aviation Examinations

WASHINGTON, Feb. 28—The War Department has issued an order temporarily suspending examinations at all aviation examining boards, owing to the fact that every aviation school in the country is crowded to the limit.

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Washington Denies Airplane Contest

WASHINGTON, Feb. 28—The Aircraft Production Board denies newspaper reports of a contest between Liberty airplanes and the Avon airplane at Washington. It states, however, that there will be flying tests at Dayton in the near future between Liberty airplanes and Rolls-Royce airplanes. There will be some Liberty airplanes flying over Washington in the near future, also, but not engaged in any contest.

—

Disagreement Over Fuel Committee

WASHINGTON, Feb. 28—It is apparent that there is considerable disagreement between the Automobile Industries Committee headed by A. W. Copeland and including Hugh Chalmers and John R. Lee and the Fuel Committee headed by W. C. Durant. There are substantial reports current around Washington that these two committees are not working in harmony and that the Fuel Committee appointed five weeks ago to deal with the question of the curtailment of coal to the automobile industry, has not invited the Automobile Industries Committee into its two informal deliberations that have been held. In fact, the Automobile Industries Committee has been entirely ignored so far as this problem is concerned. A formal committee meeting of the Fuel Committee has not been held since the appointment of the committee five weeks ago, although Dr. H. A. Garfield, Fuel Dictator, wanted as early as possible information with regard to the fuel situation in relation to the automobile industry.

It is unfortunate that a committee like the automobile industries committee, appointed to represent the industry in Washington, and in reality representing the industry there, should practically be set aside in this matter. These are days when harmony rather than discord is needed. These are days when co-operation wins more than competition.

One Organization for Ohio Factories

War Industries Commission Plans Pooling of Interests to Stop Inefficient War Buying

CLEVELAND, Feb. 27—A plan to coordinate several thousand factories, including practically every industry in two-thirds of Ohio and part of Pennsylvania, has been proposed by the Ohio War Industries Commission. In brief, the plan would convert all Ohio industries into one huge business with which the government could deal through its representantives in Cleveland. Arrangements would be made so that all inspection, purchasing and payments could be transacted directly through a Cleveland government representative, thus saving the numerous expenses incurred through dealing directly with Washington.

Under the plan proposed, all buying of parts for assemblers and manufacturers doing war work in this district would be done directly in the district. This would save transportation and loss of time. For example, if one company in the Cleveland district were buying small parts in Michigan and sending them to Pennsylvania for machining and then having them returned for assembly, this unnecessary transportation would be eliminated by having all the work done within the Ohio district.

The Ohio War Industries Commission has appointed an executive committee consisting of J. H. Foster, president of the Hydraulic Steel Co., who will have supervision over forgings and castings; E. E. Allyne, president of the Aluminum Castings Co., for aluminum castings; A. W. Henn, secretary-treasurer of the National-Acme Co., for machinery and machine products; J. H. Herron, president of the Cleveland Engineering Society, for engineering. Others include C. A. Otis, president of the Cleveland Chamber of Commerce; E. M. Fairchild, T. S. Grasselli, A. K. Printz and E. E. Teare. Representatives of automotive and rubber industries will be named in the near future.

It is the plan of the commission to divide Ohio into ten districts, each to be controlled by an executive committee with sub-committees further dividing each industry into strict classifications. For example, there are sub-committees in the castings division for gray iron, aluminum, brass, malleable iron, and steel. The Executive Committee will deal directly with a Government body

(*Continued on page* 475)

Automotive Industries

Dayton Gets S. A. E. Summer Session

June 17 and 18 Chosen—Aviation Program to Include Flying Demonstrations

DAYTON, Feb. 26—The annual midsummer meeting of the Society of Automotive Engineers will be held in Dayton, Monday and Tuesday, June 17 and 18, with Wednesday, June 19, set aside specially for those wanting to visit several of the factories engaged in aviation work. One entire forenoon will be given up to aviation demonstrations in connection with flying and other allied activities.

The decision to hold a summer meeting at Dayton came as a recommendation from the meetings committee and was approved by the Council of the Society at its monthly meeting held here yesterday. The great activity of the society in aviation matters and the fact that there are three aviation fields in Dayton were deciding factors in selecting this city for the summer meeting. Headquarters will be at Hotel Miami.

Dayton engineers held a meeting today to decide on forming a Dayton section of the Society. This section will practically take charge of all local arrangements with regard to the summer meeting. Although the city has not adequate hotel accommodations for the 700 or 900 who will attend the session, the Dayton committee will arrange a billeting system which will take care of 1000 or more members and friends.

At yesterday's meeting of the society, B. B. Bachman was appointed chairman of the Standards Committee for 1918, and a large percentage of the committee personnel decided upon. The complete appointments will not be made for some weeks yet. Bachman succeeds J. G. Utz, who filled the position last year and who is now in charge of production of the standardized war trucks. David Beecroft was appointed chairman of the meetings committee and announced as his committee F. E. Moscovics, C. F. Scott, F. E. Place and E. R. Greer.

The finance committee under Chairman H. M. Swetland consists of Christian Girl, Hugh Chalmers, Henry R. Sutphen and George H. Houston. President Kettering also appointed C. C. Hinkley chairman of the membership committee.

President Kettering gave a dinner to the Council and several Dayton friends at the new Dayton Engineers Club which was opened a few weeks ago. The club, the gift of President Kettering and Colonel Deeds, both of Delco fame, to the engineers of Dayton, is one of the most modern clubs and contains a lecture hall that will seat 400.

After the dinner the subject of discussion was the knock in the kerosene engine, the illustrated talk being given by members of the research laboratory, of which President Kettering is head.

The point was established that the knock is not due to pre-ignition but to the composition of the fuel and that detonations and almost major explosions occur after the first ignition and when the piston is well down on the stroke. These knocks are due more to the composition of the molecule than to the degree of volatility. Diagrams were shown illustrating how the knock varied with different fuels.

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Vincent and Marmon Promoted

DAYTON, Feb. 26—Major Jesse G. Vincent, chief engineer of the airplane department here, has been promoted and is now a Lieutenant-Colonel and Capt. Howard Marmon is now Major Marmon and is assistant to the chief engineer and in charge of McCook Field, the experimental and research center for airplane development of the country.

The building activity around the field is being rapidly pushed and the field put in condition for the opening of spring. Col. Vincent and Major Marmon are in complete charge not only of airplane design but experimental work as well. Major B. D. Gray, in charge of production, is now located here.

—

Morse Vice-President of Curtiss

WASHINGTON, Feb. 27—E. C. Morse, former vice-president of the Chalmers Motor Co., has been elected vice-president of the Curtiss Aeroplane & Motor Corp. He has been at Washington for some time as representative of the John Willys interests, including the Willys-Overland and Curtiss companies.

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Chandler Stock on 12 Per Cent Basis

CLEVELAND, Feb. 28—The directors of the Chandler Motor Car Co. declared a regular quarterly dividend of 3 per cent, placing the stock on a 12 per cent basis. Heretofore dividends have been paid at the rate of 2 per cent with 1 per cent extra each quarter. J. W. Prentiss, of Hornblower & Weeks, retired as a director, and was succeeded by J. A. Fayne of the same firm.

—

Younger in Army Engineering Section

WASHINGTON, Feb. 28—John Younger, truck engineer of the Pierce-Arrow Motor Car Co., Buffalo, is now serving in the engineering division of the motor transport section of the Quartermaster Corps under Christian Girl.

Chevrolet to Be G. M. Division

Status Will Be Same as Buick and Cadillac—No Change in Production Methods

NEW YORK, Feb. 23—The Chevrolet Motor Co. is soon to pass out of existence as an independent automobile producing company. Under the terms of a recommendation submitted at the annual meeting of the General Motors Corp., and soon to be ratified, it will become a division of the General Motors Co. and its status will be the same as that of other General Motors divisions such as Buick, Cadillac, Oakland, Oldsmobile, and the other large parts-making concerns. Like these companies it will go on producing automobiles as in the past and its methods of distribution will not be altered.

The Chevrolet Motor Co. at present owns a controlling interest in the General Motors Co., but when the new plan becomes effective there will be only General Motors stock outstanding. This will amount to $50,000,000 of 6 per cent preferred stock, representing an increase of $30,000,000, and $150,000,000 common stock, this being an increase of $67,400,000, both increases having been recommended.

Combined Output of 400,000 Cars

When the changes are completed, the General Motors Corp.'s various divisions will have a combined output of close to 400,000 cars a year with cars in every price class except the very lowest, ranging from the smallest Chevrolet at $685 to the Cadillac at $2,800. Chevrolet alone accounts for 125,000 cars of the 400,000.

The Chevrolet company at present owns 54 per cent of the outstanding General Motors stock amounting to 450,000 shares. It is proposed that the General Motors Corp. turn over 282,684 shares of its stock to the Chevrolet company for all its assets except the General Motors stock it now owns. In other words, when the deal is finally put through, the assets of the Chevrolet company will consist of 732,684 shares of General Motors stock. Against this there will be outstanding some 140,048 shares of Chevrolet having a present par value of $64,004,800, which is to say that the Chevrolet Motor Co. will then own one and one-seventh shares of General Motors stock for every one of its own. Under the new plan, Chevrolet will become the owner of 732,684 General Motors shares out of a total outstanding of 1,108,264.

W. C. Durant who fathered and developed the Chevrolet Motor Co., will continue head of the General Motors Co. and

chairman of the board of directors, in which there have been some changes. E. I. du Pont de Nemours & Co. have acquired substantial stock holdings in both Chevrolet and General Motors, both of which companies are controlled by the du Pont company and Durant, who is the largest single stockholder. L. G. Kaufman has resigned as a member of the finance committee but remains a director, and the du Pont company now is represented on the Board of Directors by J. A. Haskell, J. J. Rafkob, P. F. du Pont, Irenee du Pont and Henry F. du Pont, the last two being elected directors last Thursday.

The General Motors Corp. was formed Sept. 16, 1908, and at present owns the entire capital stock of the following divisions or manufacturing companies: Buick Motor Co., Cadillac Motor Car Co., General Motors Export Co., General Motors Truck Co., Jackson-Church-Wilcox Co., Oakland Motor Car Co., Olds Motor Works, Northway Motor & Mfg. Co. and Weston-Mott Co. It also owns a majority of stock interest in the Champion Ignition Co., Flint, and operates under lease the McLaughlin Motor Car Co., Oshawa, Ont., and the General Motors, Ltd., London, England.

The Chevrolet Motor Co. was formed Sept. 23, 1915, and owns all of the outstanding capital stock of the Chevrolet Motor Co. of New York, Chevrolet Motor Co. of Michigan, Mason Motor Co. of Flint, Chevrolet Motor Co. of Toledo, Chevrolet Motor Co. of Bay City; it has profit sharing relations with Chevrolet Motor Co. of Canada, Chevrolet Motor Co. of St. Louis, Chevrolet Motor Co. of California, Chevrolet Motor Co. of Texas. In addition to its 450,000 shares of General Motors stock, the company also owns 106,000 shares of common stock of the United Motors Corp. and 13,650 shares of Scripps-Booth common.

Due to the fact that this large block of United Motors stock is owned by Chevrolet, and because the same interests control both General Motors and United Motors, there is talk of having General Motors take over United Motors in the same way it has taken over Chevrolet, to make of it another General Motors division.

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Dort to Make 20,000 Cars

FLINT, MICH., Feb. 24—The Dort Motor Car Co. and its Canadian associates, Gray-Dort Motors, Ltd. of Chatham, Ont., produced about 8000 cars in 1916. Last year the production increased practically 100 per cent, and this year it is expected that the two plants will turn out 20,000 cars.

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Will Not Reveal Garabed Tests

WASHINGTON, Feb. 23—The secrets of Garabed, the new and mysterious free energy discovered by W. K. Giragossian, will not be revealed through the official tests approved by Congress. Its inventor claims that he does not wish the secret to fall into German hands and refuses to reveal the names of the five scientists who will make the tests and will not tell the exact place or the date.

Plan International Standards

American Delegates Already in England to Help Formulate System for All Allies

WASHINGTON, Feb. 23—Standardization of manufacturing materials related to production of motor cars, motor trucks, airplanes, tractors and machinery takes a new step with the announcement of arrival in England of delegates from all the allied countries for conference on International Standards.

The American delegation headed by F. G. Diffin, representing the Aircraft Production Board, arrived safely late last week and includes members from all the prominent American engineering societies: The Society of Automotive Engineers, American Society of Mechanical Engineers, American Society for Testing Materials, etc. There are also members from the Aircraft Board, the Advisory Committee on Aeronautics, the Signal Corps, the Navy, and the original International Aircraft Standard Board from which this conference is an outgrowth.

The following is the list of the American members: F. G. Diffin, Chairman; Dr. W. F. Durand, Lieut.-Commander Benjamin Briscoe, Lieut. W. F. Prentice, E. H. Ehrman, Charles M. Manley, James Hartness, Albert L. Colby, Capt. A. B. Tilt, F. G. Ericson, C. F. Clarkson and F. R. Baxter.

Will Influence Future Production

Standardization of parts and materials in America to augment industry was first emphasized through the work of Howard E. Coffin, now chairman of the Aircraft Board, and the late Henry Southern. After the war started, a paper was read by Diffin before the Society of Automotive Engineers on Aircraft Standardization, which led Coffin to place Diffin in active charge of standardization work toward international results.

The present conference is the result of Diffin's work during the past 9 months. This present congress will without doubt have considerable influence on future international manufacturing, enabling better service with less man-hour effort by relieving plants from carrying in stock materials not standardized and by concentrating on materials of known performance.

No attempt will be made by the conference to standardize airplane construction, but rather those materials and units which are at present causing difficulties in purchase and delivery and for which suitable standards can be set.

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Harroun Assets $11,186,768

WAYNE, MICH., Feb. 26—The Harroun Motors Corp. reports gross assets of $11,186,768.26 for the year ending Dec. 31. These are divided into capital assets, consisting of land and buildings, machinery and equipment, tools, dies, etc., of $1,348,295.13; patents, models and goodwill, $7,006,887.01, and treasury stock, $2,155,930. Current assets including inventory are $277,286.09; cash on hand, $157,068.10, and with accounts, notes and investments total $660,263.45. Prepayments, covering advance insurance, travelers' expenses and advances on ordnance contracts are $15,392.67.

Liabilities include capital stock, $10,000,000; deferred liabilities, $784,462.40, with current liabilities of $395,375.86.

Production of the Harroun Motors Corp. is now up to 30 per day. This production is being maintained in spite of the fact that a large contract calling for several million 155-millimeter shells has been taken by the company. It is probable also that assembly work on the Class AA truck will be undertaken at the Harroun plant, but this will not interfere with the production, which is expected to increase rather than decrease. To date the company has not had to complain of freight car facilities owing to its advantageous location on the outside of the congested belt area. It is reported that an outer belt freight line will also be established at Detroit and if this is done the line will touch Wayne.

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S. A. E. Tractor Discussion

CHICAGO, Feb. 22—Tractors, in order to be economical on a farm, should be selected in accordance with the number of cultivated acres. The relation of the S.A.E. to the automotive industry and the fundamental differences between the tractor and the motor car were the subjects discussed at last evening's meeting of the Mid-West section of the S.A.E.

David Beecroft, first vice-president of the S.A.E. and directing editor, Class Journal Co., spoke of the enlarged activities of the society and how it had been extended to take in the motor truck, aircraft, tractor, motorcycle, motor boat, and stationary engine industries in addition to the motor car industry. He also spoke of the importance of the tractor with regard to increased food production and of the close relation existing between the society and the government in furthering the latter's war plans.

Dent Parrett of the Parrett Tractor Co. spoke on the fundamental differences existing between the motor car and the tractor from the viewpoint of design and manufacture. He compared the differences between the various principal units, the reasons for these differences and their adaptation to the tractor. A paper on the Economic Size of Tractor was read by Ernest Goldberger, Efficiency Engineer, Packard Motor Car Co.

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Want Name For Sub-Chasers

WASHINGTON, Feb. 23—The Navy Department has asked the public to suggest a name for the new boats being built by Henry Ford. Two letters are wanted. Assistant Secretary Roosevelt proposed S. D. for submarine destroyers but he thinks a better name can be found. The Ford ships are going to be midway between submarine chasers and destroyers. They will use depth bombs as their principal weapon.

SIDE GUIDE & GRIPPER

No Anti-Freeze Fluids in France

Alcohol and Glycerine Needed for Explosives—Drivers Must Drain Radiators

PARIS, Feb. 10—No anti-freezing solutions are made use of in the automobile services of the French army. The best non-freezers are alcohol and glycerine, but both of these are required for making explosives, and could only be used in automobile radiators by robbing other and more important services.

It has been found possible to overcome the danger of freezing and consequent cracked jackets and radiators by causing all cooling water to be drained off every evening and during the daytime whenever it is known that trucks will have to stand for a number of hours. A general rule to this effect goes into force each winter and is applicable until repealed at some date in the spring. Drivers are individually held responsible for the observance of this rule; it is no excuse to plead that the evening was mild or that no definite orders had been given for draining off water on that particular evening. So well is this understood that French truck drivers will drain off all water if there has not been a sign of frost for weeks and if the chances of frost during the night are but one in thousands. It is a rule that the radiator plug shall be put inside No. 1 valve cap and the cylinder jacket plug in No. 8 valve cap. New drivers always know where to find the plugs.

A cracked cylinder jacket, owing to neglect to drain water, is punished by prison; a recurrence of this crime may send the culprit into an infantry regiment in the trenches. The rigid observance of this rule entails a certain amount of labor which would be avoided in any private truck service. It has the advantage, however, of reducing cracked cylinders and radiators to near the vanishing point. Before this rule went into force the loss from cracked cylinders was an important item every winter.

French trucks are not fitted with radiator and hood covers, although many drivers at the front make these covers in their own interests. English trucks are served with these covers. No European trucks are fitted with radiator thermometers, these being found only on a few makes of imported American trucks.

There is no doubt many engines are run too cold, and are inefficient, through lack of a heat indicator. Few drivers consider it necessary to cover the radiator unless it is actually freezing. Experiments with one make of Italian truck built for Alpine conditions, and extensively employed in the French army, showed that with the thermometer at 40 Fah., exactly one-half of the radiator had to be covered to get a good summer average at the outlet from the cylinders. Undoubtedly these trucks were running inefficiently with the whole of their radiator surface exposed.

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Italy Exports 6678 Cars and Trucks

TURIN, ITALY, Feb. 15—Italy still occupies the position of the leading exporting nation of Europe, according to figures issued by the Ministry of Finance. For the first 8 months of 1917 motor exports totaled $17,736,361, an increase of 96.4 per cent over the corresponding period of 1916, and 113.4 per cent over the first 8 months of 1915.

The greatest proportion of exports were trucks to the Allies, these numbering 6169, at a value of $15,927,835, as compared with 506 touring cars, at a value of $1,619,200. Practically all were fully equipped for allied service.

Imports amounted to only $200,000 for 10 trucks and 183 passenger cars.

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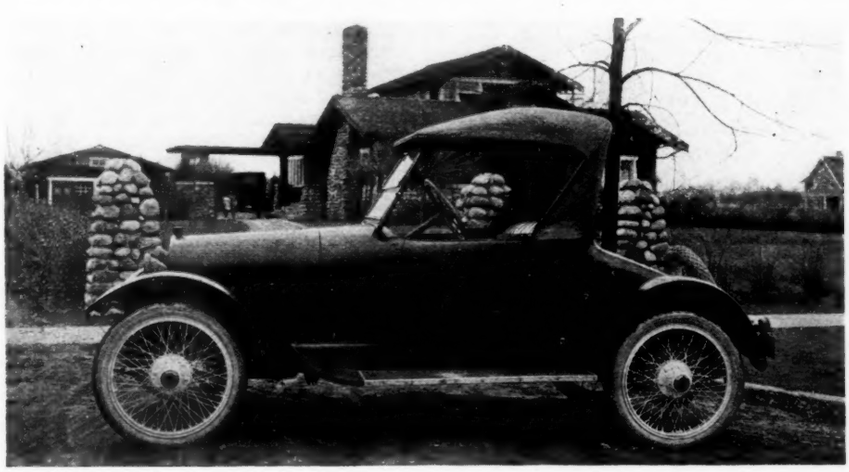
Harroun Adds Roadster Model

DETROIT, Feb. 23—The Harroun Motors Corp. has added a roadster to its line. It is a two-passenger type, but with a seat wide enough to accommodate three persons if necessary. Its general characteristics are quite similar to the Harroun touring car, and it is mounted on the same chassis. The roadster is illustrated herewith and, as will be noted, has a modified rear deck with tire carrier in the rear. The price of the Harroun roadster is $995, and wire wheels are $100 extra.



1917 Copper Supply Decreases

Smaller Production and Increased Exports Causes of Reduction

DETROIT, Feb. 25—The copper yield of the United States during 1917 had a value of $510,000,000. Arizona produced the most copper, the output being 687,800,000 lb.; Montana, second, with 278,000,000 lb.; Michigan, third, with 275,000,000 lb.; Utah fourth, with 245,000,000 lb. and Nevada fifth, with 110,000,000 lb.

The total production of copper in this country in 1917 was slightly less than 1916, according to preliminary figures and estimates collected by B. S. Butler of the United States Geological Survey. The average price of copper during 1917 was 27 cents per lb., and for 1916 it was 27.2 cents per lb. The average quoted price in 1916 was about 2.5 cents more than that received, while the average for 1917 was probably near the quoted price.

The total production of blister and lake copper from domestic ores was 1,890,000,000 lb. in 1917, as against 1,928,000,000 lb. in 1916. The output of refined copper, including electrolytic, lake, casting and pig from primary sources, domestic and foreign, for 1917 is estimated at 2,362,000,000 lb., as compared with 2,259,000,000 for 1916. The output of refined copper, including electrolytic, lake, casting, and pig from primary sources, domestic and foreign, for 1917 is estimated at 2,362,000,000 lb. as compared with 2,259,000,000 for 1916.

Imports of Unmanufactured Copper

According to the bureau of foreign and domestic commerce, the imports of unmanufactured copper of all forms for the first 10 months of 1917 amounted to 460,780,000 lb., as against 397,594,000 lb. for the first 10 months of 1916. The imports for the year 1916 were 462,335,000 lb.

The exports of pig, ingots, bars, plates, sheets, rods, wire, and lake copper products for the first 10 months of 1917, as determined by the bureau of foreign and domestic commerce, amounted to 953,876,000 lb.; the exports for the first 10 months of 1916 were 655,473,000 lb. Similar exports for the year 1916 were 784,006,000 lb.

At the beginning of 1917 about 128,000,000 lb. of refined copper was in stock in the United States. By adding this quantity to the refinery output of the year, it will be seen that the total available supply of refined copper, exclusive of secondary copper, was about 2,490,000,000 lb. By subtracting from this quantity the exports for the first 10 months and the estimated exports for the last 2 months, and assuming no change in stocks, it will be seen that the supply available for domestic consumption in 1917 was materially less than the 1,430,000,000 lb. available in 1916.

SIDE GUIDE & GRIPPER

Fisk Profits Double in 1917

Amount to $3,578,484.57 Before Deduction of Taxes—Equal $42 a Share on Common

CHICOPEE FALLS, MASS., Feb. 26—The fifth annual report of the Fisk Rubber Co. shows net profits for 1917 of $3,578,484.57. This almost doubles the $1,836,829.86 earned in 1916. The earnings last year amounted to $16 a share on the $21,525,000 outstanding stock, after all dividends were paid.

The profit and loss and surplus account follows:

Surplus, Balance December 31, 1916		$1,875,442.37
Add:		
Net profits for year ending December 31, 1917, after deducting manufacturing costs, depreciation and interest on borrowed money, but before providing for 1917 Federal income and excess profits taxes		3,578,484.57
Nominal value of 25,500 shares of Federal Rubber Co. common stock, par value $100.00 each, received for sundry services, etc., for which no specific charge was made		1.00
		$5,453,927.94
Deduct:		
Dividends paid:		
First preferred stock	$631,750.00	
Second preferred stock	341,100.00	
	$972,850.00	
Surplus appropriated for retirement of first preferred stock	105,328.81	
Premium paid on 3750 shares first preferred stock retired January 18, 1917	34,819.71	
Provision for insurance liability on stock and equipment at branches assumed by the company	30,000.00	
Payment of taxes applicable to prior periods	5,536.45	
		1,448,534.97
Surplus, balance December 31, 1917		$4,005,392.97

Following is the balance sheet of the company on Dec. 31, 1917:

ASSETS

Capital Assets:		
Land, buildings, machinery etc., at Chicopee Falls and equipment in branches all at depreciated values		$7,040,415.67
Manufacturing rights and leasehold property		106,030.99
Good will		8,000,000.00
Total		$15,146,446.66
Investments		284,622.63
Current Assets:		
Merchandise, raw, process and finished		$17,737,637.58
Tires under mileage contracts		68,561.01
Receivables, less bad debt reserve		6,262,541.01
Collateral notes — employees stock subscription account		462,717.41
Cash		1,658,894.20
Total current assets		$26,190,351.21
Deferred charges		365,348.35
		$41,986,768.85

LIABILITIES

Capital Stock:		
First preferred non-convertible		$4,025,000.00
First preferred convertible		5,000,000.00
Second preferred		4,500,000.00
Common		8,000,000.00
Total capital outstanding		$21,525,000.00
Current Liabilities:		
Loans payable		$11,375,000.00
Accounts payable		3,311,683.01
Accrued wages		24,010.20
Dividends due, not paid		6,706.00
Total		$14,715,399.21
Reserves:		
Balance 1914 reappraisal		$104,577.23
Insurance liability assumed		40,608.26
Guarantee		215,462.37
Total		$360,647.86
Surplus appropriated for retirement of first preferred stock		$1,380,328.81
Surplus		4,005,392.97
		$41,986,768.85

BERNARD M. BARUCH

Who has been appointed head of the War Industries Board, succeeding Daniel Willard, resigned

Fuel Committee Meets

WASHINGTON, Feb. 27—A preliminary, informal meeting of the Fuel Committee, of which W. C. Durant is chairman and which later is to confer with Fuel Administrator Garfield, was held here Tuesday and Wednesday. Among those present were: W. C. Durant, Hugh Chalmers, M. F. Maxwell, Roy Chapin, W. N. Peek, Walter Chrysler, Richard Collins, L. M. Bradley, W. C. Rands, George Graham, John Willys, J. D. Dort and Alfred Reeves.

Baruch Made Head of War Board

Succeeds Willard and Probably Will Have Considerably Broader Powers

WASHINGTON, Feb. 26 — Bernard Baruch was to-day named chairman of the War Industries Board, succeeding Daniel Willard, who has resigned. The appointment of Baruch, who on Aug. 25, 1917, was given a place on the War Council Board and made chairman of the Purchasing Board of the Council of National Defense, is taken to mean that President Wilson is practically assured of the passage of the Overman bill. This bill gives the President enlarged powers and would permit him to consolidate buying from scattered departments and bureaus and place it under the control of some central agency. Baruch, in testifying before the Senate Committee, strongly urged a central organization for purchasing. It is expected he will fill, to a great extent, the function of Minister of Munitions but without holding a cabinet seat. The Overman bill would give the President executive power to centralize purchasing power under Baruch's direction.

The whole board probably will be reorganized and enlarged to include representatives of the Shipping, Railroad, Food and Fuel administrations. The new board it is stated will have large authority regarding questions of priority, manufacture and transportation. It is likely that the board will be made independent of the Council of National Defense of which it is now a part.

Boston Show Opens Saturday

BOSTON, Feb. 27—Boston's show, the last big exhibit of the season, opens Saturday. There will be both cars and trucks, and quite a few of the latter, because many of the dealers now have truck agencies and all are looking for a good truck business in New England this year.

The show comes at the beginning of the selling season and is always a good buying show. The prospects seem especially good right now. There was a sales slump during January, but things have been picking up lately and conditions are much better now.

A rally meeting of New England dealers is to be held Monday noon at a luncheon. E. Le Roy Pelletier, nationally known as an advertising man, will tell a story of optimism and why dealers should seek and expect good business. Pelletier has talked at several western meetings during shows.

Briscoe Prices Up $100

JACKSON, MICH., Feb. 27—Prices of the Briscoe 4-passenger touring car, roadster and open delivery truck will be advanced $100 on March 1. The present price is $725 for all three, but after Friday they will be listed at $825.

Shipbuilding Plant for Ford

$2,000,000 Plant of Five Buildings Covering 5 Acres to Be Ready in 75 Days

DETROIT, Feb. 25—Henry Ford will erect a new shipbuilding plant at River Rouge to complete the manufacture of submarine destroyers. Construction work on the buildings has already been started, and it is expected that the plant will be completed in 75 days. There will be five buildings, covering an area of 5 acres, and costing, including equipment, approximately $2,000,000. The plant will comprise a fabricated shop, 150 x 450 ft., where parts for hulls will be made; three assembling plants, 100 x 1700 ft., and a fit-up shop, 100 x 1500 ft. The buildings alone will represent an outlay of $1,000,000. The power plants and other machinery will be manufactured at the Highland Park plant of the Ford Motor Co.

Chain System Employed

The material for the chasers will enter the fabricated plant from which the hulls will come out on tracks to each bay of the assembling stations. The hulls then move along, parts being constantly added until they are ready for the transfer table, from which the hulls drop into the water on a hydraulic lift. After the boats are floated the installation of motor parts, boilers and armament begins, the last addition being a wireless. The boat is then ready for the submarine zone.

When the plant is complete and in operation, it will give employment to from 10,000 to 15,000 men. A canal, or slip, from the Rouge River to the plant is now being dredged.

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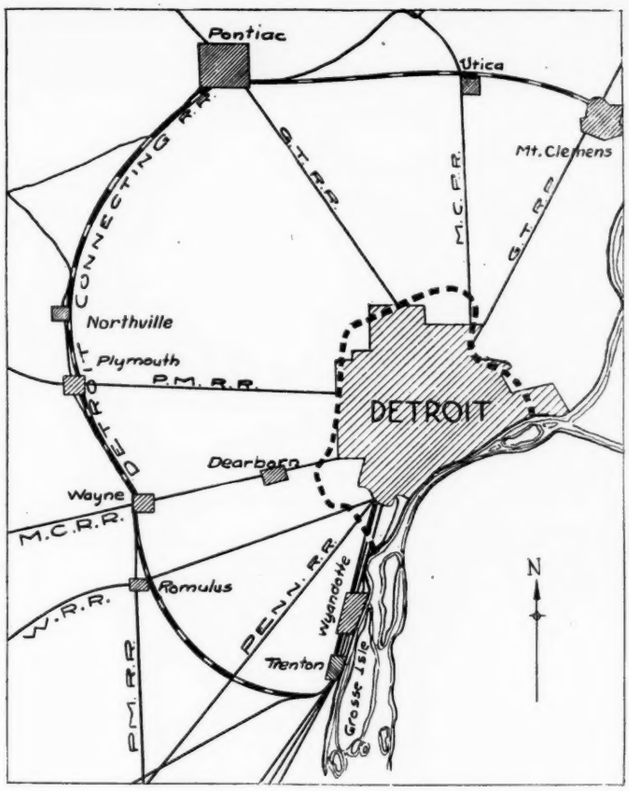
Ford & Son Make 75 Tractors Daily

DETROIT, Feb. 27—Henry Ford & Son are now building 75 tractors a day, and will double production within 30 days. The order for 1000 tractors to be sent to the Canadian government will be completed by April. The company has an option on making an additional thousand for Canada.



It is planned to build an inner belt line for railroads entering Detroit so that loading and unloading may be facilitated. The dotted line shows the route of the proposed new belt

One Organization for Ohio

(*Continued from page* 470)

to be appointed in Cleveland and which is to be headed by Samuel Scovil, who has been named by the Ordnance Department to represent it in the Cleveland district.

The commission hopes by this pooling arrangement to make war buying less wasteful and more efficient.

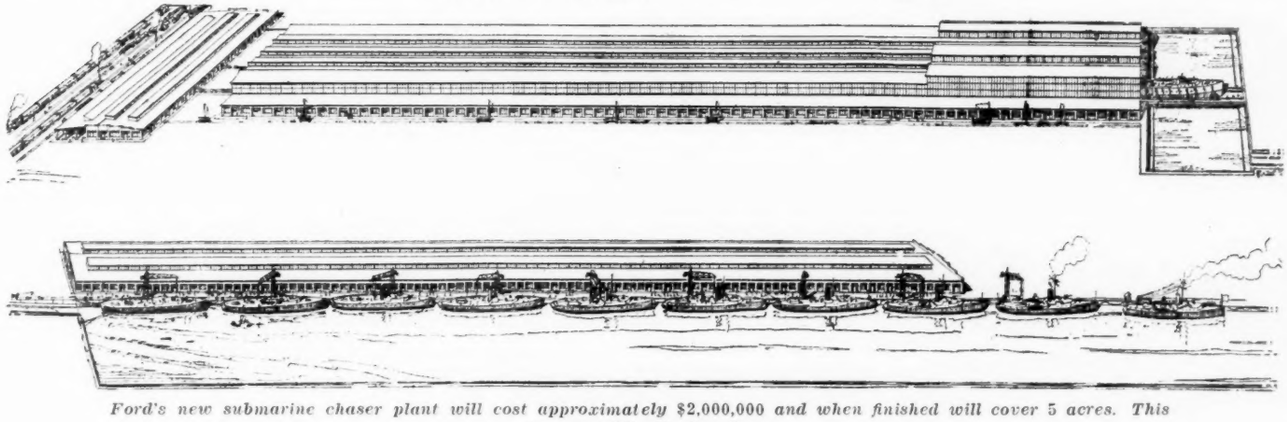
Blue prints and specifications of all manufacturing plants will be filed in the offices of the Ohio War Industries Commission for consultation by government officials. Every industry in Cleveland and Akron is a member of the commission, including such companies as Winton Motor Car Co., Chandler Motor Car Co., White Co., Standard Parts Co., Willard Storage Battery Co., Grant Motor Car Co., Peerless Motor & Truck Corp., Miller Rubber Co., Goodyear, Goodrich, Firestone and others.

Plan Outer Belt Road for Detroit

DETROIT, Feb. 27—The Detroit Connecting Railroad has been organized here with $500,000 capital to operate an outer belt line around this city. The proposed road will terminate at Mt. Clemens, on the north, and Trenton on the south, and will pass through Utica, Pontia, Northville, Plymouth, Wayne and Romulus. A belt line of this sort, it is thought, will relieve freight congestion and permit earlier deliveries.

Manufacturers often have to wait 4 to 6 days before freight cars which arrive at a point near the city can reach the unloading station. The outer belt line, by taking care of the needs of the small towns nearby, and increasing the track facilities, will leave the inner belt free for local needs.

It is expected that the road will be ready for operation within the next 12 months.



Ford's new submarine chaser plant will cost approximately $2,000,000 and when finished will cover 5 acres. This is an architect's drawing

manufacturer give the bureau information concerning its overland haulage needs so that this data may be included on cards similar to those on which the trucks data is kept and inserted in the front part of the filing cabinet in each bureau.

Thus, when a shipper calls up any bureau and asks for the names of available truck owners to haul goods between any two cities, the method is simply to determine the number of the route and then give the shipper the names of the truck owners operating vehicles over that route. Reversely, the names of shippers or manufacturers in any particular city may be had by scanning the cards in the front of the file.

Telephone Numbers Listed

To make it easier for either shipper or truck operator to get in touch with the bureau, the Connecticut organization has arranged to have the regular telephone number of the chamber of commerce listed a second time in the book under the heading "Return Loads." This makes it very convenient for a strange truckman to reach any particular bureau and find out the names of concerns which might have a return load to be hauled to its home city.

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Another Truck Train Arrives

WASHINGTON, Feb. 24—The first truck train of several which left Detroit within the last 10 days arrived at Baltimore to-day with its full quota of 30 trucks. The trip was made in 8 days, the average distance being 72 miles per day for the 575-mile journey. The highest day's mileage was 97.4 miles over smooth straight roads and 85.4 miles through the mountains. The second truck company reached Bedford, Pa., last night.

Ford Car Price Increase of $90—Chassis $75 More

Klingensmith Ascribes Raise to Greater Cost of Material

DETROIT, Feb. 25—The Ford Motor Co. has increased the price of its cars $90 and its chassis $75. The price of the truck chassis remains unchanged. The increase is not altogether surprising to dealers who for some time have been urging early purchases in view of a possible increase. Only last week, however, Frank Klingensmith, treasurer of the Ford company, stated positively that no increase was in contemplation.

Klingensmith ascribed the increase to the rising cost of materials. It is likely that the reduced output of the Ford company also has had an important bearing, the present production being but 1500 cars a day as against 3000 a short time ago. With the output thus reduced 50 per cent, it is but natural that materials cannot be purchased in such large quantities as with a normal output.

FORD PRICES

Model	Old Price	New Price	Increase
Touring	$360	$450	$90
Roadster	345	435	90
Chassis	325	400	75
Truck chassis	600	600	..

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O'Donnell Heads Oil Production

WASHINGTON, Feb. 22—T. A. O'Donnell, Los Angeles, Cal., has been appointed in charge of oil production for the oil division of the United States Fuel Administration.

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Guilford Truck in Greensboro

GREENSBORO, N. C., Feb. 26—The Guilford Motor Truck Co., recently organized with $250,000 capital, and established at Martinsburg, W. Va., will move here as soon as a factory can be leased. The company will manufacture a 1-ton truck to sell for $1,075, with a 130-in. wheelbase, worm drive, electric lights and starter. Materials sufficient for the manufacture of 2000 trucks, with the exception of engines and rear axles, have already been purchased and will be transferred from Martinsburg.

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Maccar Truck Prices Increased

SCRANTON, PA., Feb. 26—List prices of Maccar trucks have been advanced as follows:

Model	Capacity	New Price	Old Price
L	1½-ton	$2,550	$2,450
H	2½-ton	3,100	2,950
M	3½-ton	3,850	3,600
U	5½-ton	4,750	4,500

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Mid-West Mfg. Starts Production

HASTINGS, MINN., Feb. 26—The Mid-West Mfg. Co., organized here recently with a capital of $50,000, has started operations. The company will manufacture airplane parts and commercial bodies.

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Sweden Plans Airplane Mail Service

WASHINGTON, Feb. 25—Sweden is considering proposals for the establishment of airplane postal service between Stockholm and Abo and Stockholm and Petrograd. The service between Stockholm and Petrograd would reduce the time of postal transit from 5 days to 25 hours, and from Stockholm to Abo from 4 days to 6 hours.

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Savannah Dealers Organize

SAVANNAH, Feb. 26—Savannah dealers have organized the Savannah Automobile Dealers' Assn., with C. E. Vinson, head of the C. E. Vinson Motor Co., as president. L. H. Dimmitt was elected secretary and treasurer.

Automotive Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Net Ch'ge
*Ajax Rubber Co.	53	57½	+4½
*J. I. Case T. M. Co. pfd.	83	85	—1
Chalmers Motor Co. com.	5½	7½	— ½
Chalmers Motor Co. pfd.	25	40	..
*Chandler Motor Co.	89	91	+7
Chevrolet Motor Co.	128	129½	+8½
*Fisher Body Corp. com.	28	30	—5
*Fisher Body Corp. pfd.	80	87	+2
Fisk Rubber Co. com.	50	53	—2
Fisk Rubber Co. 1st pfd.	98	103	..
Fisk Rubber Co. 2nd pfd.	70	75	+5
Firestone Tire & Rubber Co. com.	96	98	..
Firestone Tire & Rubber Co. pfd.	97½	100½	+1½
*General Motors Co. com.	125	126½	—7½
*General Motors Co. pfd.	83	85	..
*B. F. Goodrich Co. com.	41½	42½	—4½
*B. F. Goodrich Co. pfd.	93	100	..
Goodyear Tire & Rubber Co. com.	135	140	—5
Goodyear Tire & Rubber Co. pfd.	98	100	—1
Grant Motor Car Corp.	2	3	..
Hupp Motor Car Corp. com.	2	2½	— ¾
Hupp Motor Car Corp. pfd.	75	80	..
International Motor Co. com.	13	17	..
International Motor Co. 1st pfd.	35	45	..
International Motor Co. 2nd pfd.	14	17	—3
*Kelly-Springfield Tire Co. com.	45	48	+1
*Kelly-Springfield Tire Co. 1st pfd.	75	80	—1
*Lee Rubber & Tire Corp.	15	16	+1
*Maxwell Motor Co., Inc., com.	27½	28½	— ½
*Maxwell Motor Co., Inc., 1st pfd.	60	63	—1
*Maxwell Motor Co., Inc., 2nd pfd.	24	25	+1
Miller Rubber Co. com.	135	140	—10
Miller Rubber Co. pfd.	95	98	..
Packard Motor Car Co. com.	96	104	+1
Packard Motor Car Co. pfd.	90	93	—1
Paige-Detroit Motor Car Co.	18	19	..
Peerless Truck & Motor Corp.	17½	18½	..
Portage Rubber Co. com.	113	115	+1
Reo Motor Car Co.	18	19	+ ½
*Saxon Motor Car Corp.	10	11	..
Standard Motor Construction Co.	12	13	+2½
Standard Parts Co.	65	68	—1½
*Stewart-Warner Speed. Corp.	56	58	—1
*Studebaker Corp. com.	51	52	..
*Studebaker Corp. pfd.	92	96	—1
Swinehart Tire & Rubber Co.	..	35	—2
United Motors Corp.	28⅜	28⅝	+3⅝
*U. S. Rubber Co. com.	56½	57½	—1
*U. S. Rubber Co. pfd.	100	102	+1
*White Motor Co.	44	45	+1
*Willys-Overland Co. com.	18½	19¼	..
*Willys-Overland Co. pfd.	80	81	+1

*At close Feb. 23, 1918. Listed N. Y. Stock Exchange.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANG

ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co.	7¼	8½	..
Bower Roller Bearing Co.	17	19	— ½
Chevrolet Motor Co.	132	134	+13
Commerce Motor Car Co.	6¾	..	+ ¾
Continental Motor Co. com.	6	6⅛	+ ¼
Continental Motor Co. pfd.	..	..	..
Edmunds & Jones com.	..	..	..
Edmunds & Jones pfd.	..	..	..
Ford Motor Co. of Canada	212	..	+34
Hall Lamp Co.	..	14½	..
Michigan Stamping Co. com.	13¼	14¼	+ ½
Motor Products	..	..	..
Packard Motor Car Co. com.	99	101	+4
Packard Motor Car Co. pfd.	92¼	..	+1¼
Paige-Detroit Motor Car Co.	19⅛	19¾	+1½
Prudden Wheel Co.	..	16	—2½
Reo Motor Car Co.	18¾	19	+1⅜

INACTIVE STOCKS

Atlas Drop Forge	..	30	..
Kelsey Wheel Co.	83	90	+1
Regal Motor Car Co.	..	26½	..

Men of the Industry

Changes in Personnel and Position

Templar Motors Corp. Adds to Organization

CLEVELAND, Feb. 26—The Templar Motors Corp. has made several additions to its organization. Charles E. Taylor, who has been connected with Peerless, Chandler and Hal companies, is now in charge of factory production. Thomas McKay, who served 12 years as master mechanic of the Whitney Mfg. Co., has been appointed to a similar position with the Templar organization, and James Farr, who has had 7 years of training in ordnance work in England, is the new superintendent of munitions production.

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Clinton B. Amorous, who has been connected with the sales department of the Locomobile Co. of America for several years, and formerly held the position of assistant purchasing agent, has been commissioned a major in the Signal Corps. At present he is stationed at Washington.

W. F. Schmitt, for many years connected with the Packard-Missouri Motor Co., St. Louis, has been elected vice-president of the organization.

W. B. Cockran has been appointed western sales manager of the United States Motor Truck Co., Cincinnati. He will have headquarters in San Francisco.

T. P. Chase, for several years chief engineer of the King Motor Car Co., Detroit, has resigned.

J. B. Slegfried has been appointed general manager of the King Motor Car Co., Detroit. He has been an executive of the company for several years, first as production manager and later as assistant general manager.

William Burgess Nesbitt, who for 5 years has been advertising manager of the King Motor Car Co., Detroit, has been elected vice-president of the company, to succeed T. E. A. Barthel. His headquarters will be at 50 Union Square, New York.

A. C. Webb has been appointed district sales representative of the Fulton Motor Truck Co. with headquarters in Atlanta. He will have charge of sales in 7 states.

Louis Schwitzer has been elected president of the Automotive Parts Co., Indianapolis, manufacturer of cooling fans and other accessories. He was formerly vice-president and chief engineer of the Oakes Co., Indianapolis.

Lloyd A. Bachman, formerly purchasing agent for the J. C. Wilson Truck Co., is now connected with the Commonwealth Brass Corp., formerly the Lavigne Mfg. Co., Detroit. He will have charge of publicity and research work.

F. M. Holden, formerly in the airplane engineering department of the Signal Corps at Washington, is now research engineer of the Cadillac Motor Car Co., Detroit.

Harold G. Wilson, for 7 years sales engineer of the automobile division of the Hyatt Roller Bearing Co., Detroit, who left that position to join Holley Brothers, has returned to the Hyatt company to represent the tractor division in Detroit territory.

Owen Moynihan has been appointed general sales manager of the Amazon Rubber Co., Akron. He was formerly manager of the New York branch.

C. E. MacConnell has joined the sales engineers staff of the Hyatt Roller Bearing Co. MacConnell was formerly advertising manager of the Detroit branch of the Goodrich Rubber Co.

K. C. Miller, after 6 years' service in the ordnance department of the Root & Vandervort Co., Rock Island, Ill., has resigned to become chief engineer of the Wright-Martin Aircraft Co., New Brunswick, N. Y.

A. J. Jackson, for several years sales manager for the Kissel-Kar in Davenport, Iowa, has resigned to become sales manager for the Day-Elders Motor Corp., New York, and will have charge of Iowa and western Illinois territory. He was formerly with the Pierce-Arrow company.

A. R. Miller, former vice-president of the Wolverine Automobile Club, and sales representative of the Troy Wagon Works Co., Detroit, has been appointed district sales manager for the same company. He will have headquarters at Philadelphia.

J. A. Holihan has been appointed general sales manager of the Standard Motor Truck Co. He was formerly assistant general manager of the Briscoe Mfg. Co., and later president and general manager of the Holihan Mfg. Co. For the last 2 years he has been district sales manager for the Federal Motor Truck Co.

William D. Paine, for the last 10 months eastern sales manager for the Saxon Motor Car Corp., stationed at York, Pa., has been commissioned a captain in the Ordnance Reserve Corps.

W. H. Thompson, for many years with the Westinghouse Electric & Mfg. Co., has resigned. He will become works manager of the Fairmont Mining Machinery Co., Fairmont, W. Va.

R. F. Jackson, formerly assistant sales manager of the Zenith Carbureter Co., has been appointed sales engineer, succeeding P. E. Miquelon, who has been placed in charge of the Chicago branch.

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Aeronautic School for Pittsburgh

WASHINGTON, Feb. 25—An aeronautic school to be styled Langley Laboratory of Aeronautics will be erected shortly at the Carnegie Institute of Technology at Pittsburgh. It is expected that the airplane building will be ready in 30 days.

New Companies Formed

Latest additions to ranks of Automotive Industries

Wohlrab Company Starts Production of Truck Gears

RACINE, WIS., Feb. 25—The Wohlrab Gear Co., recently incorporated here, is just starting production of a split-nut steering gear for motor trucks. This is designed to operate with oil instead of grease, due to special construction of the housing and exterior arrangement. The company has $75,000 capital and is organized under the laws of Wisconsin. T. B. Wohlrab is president, E. M. Caskey vice-president, E. J. Smieding secretary, and J. G. Kluyskens export sales manager.

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STANLEY, WIS., Feb. 25—The Badger Chemical Co., organized with $500,000 capital, will establish a chemical and refining plant here. The company will make wood alcohol, with charcoal, potash and other chemicals as by-products. The incorporators are Charles Friend, Bernard Rosenow and A. E. Kopps, Milwaukee.

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KAUKAUNA, WIS., Feb. 26—Mayer Bros., Inc., Antigo, Wis., have combined with business men of this city and organized the Kaukauna Machine Works to manufacture the Mayer power hammer, trade-marked Little Giant. The machine shop and foundry of A. W. McCean & Co. has been purchased, and production will be started in a few months. The Mayer power hammer ranges in size from 25 to 100 lb. capacity and larger sizes will be added.

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McKEESPORT, PA., Feb. 25—R. V. Trader & Co. has been organized here to manufacture a fuel-saving carbureter for trucks. A building has been purchased and remodeled as a factory, and limited production is already going on. New machinery will be installed shortly and production increased. Philip Palmgreen, formerly with the Westinghouse Electric & Mfg. Co., is in charge of the factory.

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Swan & Finch 65 Years Old

NEW YORK, Feb. 25—The Swan & Finch Co., maker of lubricants, celebrated its sixty-fifth anniversary recently. The business started in 1853 in a small building on Water Street, New York.

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George K. Birge Dies

BUFFALO, Feb. 25—George K. Birge, founder of the Pierce-Arrow Motor Car Co., Buffalo, died last week. In 1896 he reorganized the George N. Pierce Co., then manufacturing bicycles, and established it firmly as an automobile manufacturing company.

Industrial Review of the Week

A Summary of Major Developments in Other Fields

Coal Shipments Moving Regularly from Mines

For the first time in many weeks shipments from the mines are moving with moderate regularity. Reports from all sections, with the exception of the New England States, indicate that the coal crisis is over. However, this does not mean that the danger of a recurring scarcity is entirely removed, but that with a continuation of good weather distressing periods such as the country has just experienced are improbable.

The chief trouble still is lack of motive power, and many loaded cars yet remain on sidings on this account. A report by Government investigators shows that thousands of cars in poor condition clog the terminals and impede delivery. Railroad companies state they are unable to get sufficient men to keep up repairs. An appeal to mining companies for the transfer of men with mechanical ability has met with some success.

The general public expressed much satisfaction at the demise of "heatless Monday." Some industrial plants are working on close margins of fuel supply. Anthracite is still scarce, though the mines are shipping large quantities to tidewater. The resumption of waterborne traffic will also aid in the movement of coal and take some pressure off the railroads.

Radical changes in distribution routes are in prospect. So great is the demand from the East that a plan of coal distribution, approved by the Fuel Administration, proposes that Eastern seaboard states shall have first choice on the output of anthracite. This means that after April 1 states in the West and Northwest will not be permitted to receive hard coal. This will be true also of Canada and the South. The mines of the Middle West will thus have their natural markets pretty much to themselves.

The committee in charge of the zoning plan seems to be making but little progress. It has been found to be a more difficult proposition than at first contemplated. Theoretically the arrangement seems ideal, but so many difficulties have beset the practical application that it looks as if the plan will not be ready for operation for some time.

The announcement that the 15 to 30c. commission which jobbers are now permitted to add to the mine price will be done away with after April 1 has been received with consternation by many middlemen. It cannot be denied, however, that the order will tend to eliminate a great deal of profiteering on the part of some operators who established subsidiary companies for the express purpose of selling coal, thereby absorbing this commission. Under the new ruling retail dealers will obtain coal at the same price, whether they purchase it from the mine or through a middleman.

A New Service

¶ Herewith AUTOMOTIVE INDUSTRIES *supplies for the benefit of its readers a general summary of important developments in other fields of business. This is rendered possible by the editorial co-operation of leading industrial publications which are recognized authorities.*

By compressing the general industrial situation into this form we hope to give our readers a clear and comprehensive idea of up-to-the-minute developments which they could otherwise secure only with considerable expenditure of time and effort.

Production will doubtless be greatly stimulated by the order of the Fuel Administrator granting an increase of 60c. a ton for coal mined in the central Pennsylvania district. This will go far toward encouraging the investment of further capital in development work.—*Coal Age.*

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New England Suspends Heatless Mondays

BOSTON, Feb. 27—The New England states, which continued "Heatless Mondays" after fuel administrators of the other states suspended them have also suspended them, under the fuel administration order of Jan. 17.

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Cleveland Truck Dealers Organize

CLEVELAND, O., Feb. 26—The Commercial Car Dealers Assn. of Cleveland was formed here last week by 40 truck distributers. H. L. Schneider, manager of the Republic Motor Sales Co., who presided at the first meeting, has appointed a committee of five men to draft a constitution. This local organization will foster the work of the truck committee of the N. A. C. C. The formation of the committee was in response to suggestions made at a recent convention of truck manufacturers by Christian Girl, who is director of production of the Government's military truck division; Hugh Chalmers, chairman of the automobile industries committee, and by Roy D. Chapin, chairman of the highways committee and president of the Hudson Motor Car Co. This week will see the local association completely organized.

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War Truck Inspection in Cleveland

CLEVELAND, Feb. 26—An office has been opened here in charge of Captain A. A. Gould for the furtherance of inspection and production of Class B, Class A and Class AA war trucks which are being constructed and which will be constructed in Ohio and neighboring states. Captain Gould was formerly in the designing department of the Peerless Motor Car Co.

Iron and Steel Industry Shows Big Improvement

The improvement in iron and steel works operations has gone further, as indicated by 75 per cent blast furnace operations at Steel Corporation plants, accompanied by 85 per cent active ingot capacity and 80 to 85 per cent in rolling mills. Some companies have not fared so well. Eastern Pennsylvania, which was hardest hit, it still very short of coke, and blast furnaces there have scarcely exceeded a 50 per cent operation, with steel works at 60 per cent or less.

Pittsburgh and nearby districts are suffering from new car shortages. Loaded cars have left the mills, but are not returning, and the giving of special priority to food shipments has resulted in the sending of empty cars all the way from the East to the far West. Coke shortages are much aggravated from this cause.

Want Prices Stabilized

Steel manufacturers will confer in New York on Friday preparatory to a meeting with Government representatives to consider the prices that will prevail after April 1. Steel producers, after months of hamperings, with steadily advancing costs, now ask for stabilized prices over a period of six to nine months. The uncertainty as to prices and pig-iron and steel supply is beginning to affect consuming industries in a number of lines, and the next conference at Washington is considered of more moment than any that have preceded it.

Foundry operations have been curtailed here and there for lack of pig iron, but there are also cases in which the demand for castings has fallen off because certain industries in the less essential class have found their sales diminishing or have had to stop for lack of fuel.

Fabricated steel business dropped to 95,000 tons in January, from the 205,000 ton total of December. When the rush for munitions plants had run its course in 1915, culminating in 208,500 tons of fabricated work in December of that year, the total for January, 1916, fell to 119,000 tons. The recent large lettings of fabricated steel for ships now leave little before the bridge and structural shops.

The scrap trade is accepting the new rulings of the regulating committee, notwithstanding the deviations from long established price relations. Opposing views on the question of commissions to holders of yard stocks have not yet been threshed out and meanwhile authority for the payment of commissions is lacking. On the decision hangs the movement of a considerable tonnage of heavy melting steel, which would require some inducement to draw it to the Pittsburgh district.—*Iron Age.*

Mitchell Making F. W. D. Trucks

RACINE, WIS., Feb. 26—The contract accepted by the Mitchell Motor Car Co., for the manufacture of F. W. D. trucks, licensed by the Four Wheel Drive Auto Co., Clintonville, Wis., is being filled. The Mitchell company became a sub-contractor under the contract which the latter company received from the government. As soon as this initial contract was given, another and larger contract was awarded direct to the Mitchell company. It is impossible to state the exact volume of these contracts, but they will doubtless aggregate $15,000,000.

The Mitchell plant has been increased in size to take care of this large volume of business.

Wilson Body to Make Airplane Parts

BAY CITY, Feb. 26—The C. R. Wilson Body Company has received an order from the Government for 1000 sets of parts for airplanes, the production of which will commence in 30 to 40 days.

Republic Buys Los Angeles Factory

ALMA MICH., Feb. 22—The Republic Motor Truck Co. has purchased a steel structure located in the 3-mile circle in Los Angeles, including 12½ acres of ground. This is to be used as a branch factory to supply dealers in the South and West and also to attend to the foreign business of the company in Japan, China, Hawaiian Islands, the Philippines, Mexico and South America.

American Truck to Succeed Blair

NEWARK, O., Feb. 26—The Blair Motor Truck Co. will within a week or 10 days sell all of its assets to a new corporation to be styled the American Motor Truck Co. The new corporation will continue to manufacture the truck and will take over the entire good will of the Blair organization. The new company is in the process of organization at the present time and will announce its new offices shortly.

Tire Machine Patent Infringed

CLEVELAND, Feb. 27—The DeLaski & Thropp Circular Woven Tire Co. has been granted an injunction restraining the Miller Rubber Co. from using tire making machines built under patent No. 1,011,450. The Miller company stated in its answer that the patent was not infringed and that the use of machines had ended before the beginning of the suit. Judge D. C. Westhaven held, however, that the DeLaski & Thropp company is entitled to an injunction and if desired a master may be appointed to state an accounting of profits and damages.

Second Chicago Used Car Show

CHICAGO, Feb. 27—The second annual used car show of the Chicago Automobile Trade Assn. will be held at the Coliseum during the week beginning March 30. The main building will be devoted exclusively to passenger cars, and in the annex accessories and trucks will be shown.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

White Erecting War Buildings

CLEVELAND, Feb. 27—The White Co. is erecting two new buildings to be devoted to war work. They will cost approximately $500,000.

To Auction Pathfinder and Springfield Body Plants

CHICAGO, Feb. 26—Two well-known automobile plants will be auctioned by Samuel L. Winternitz & Co. The first is that of the Springfield Body Co., Detroit, which will be put under the hammer within 30 days. On March 5 the entire stock, machinery, equipment and finished cars of the Pathfinder Motor Co. of America, Indianapolis, will be auctioned. The property inventory amounts to more than $500,000.

Termaat & Monahan Wind Up Business

OSHKOSH, WIS., Feb. 25—The affairs of the Termaat & Monahan Co., maker of machine tools, gas engines and shop specialties, have been wound up with the distribution of a first and final dividend of 23.45 per cent, amounting to $21,332.50. The company went into the hands of a receiver last September. A reorganization committee took over the plant and business shortly after, and the organization, under the style T. & M. Mfg. Co., has been in production ever since.

Hower Manager of New London Factory

TOLEDO, Feb. 25—Henry H. Hower, manager of the Willys-Knight division of the Willys-Overland Co., will become manager of a large plant manufacturing navy supplies at New London, Conn. His change of position is only for the duration of the war, when he will return to his former duties with the Willys-Overland company.

Detroit Body Enlarges Plant

PONTIAC, MICH., Feb. 25—The Detroit Weatherproof Body Co. is enlarging its plant and expects to increase its daily production of sedan tops from 150 to 250. The manufacture of truck cabs and probably other divisions of the body building business will be engaged in by the company.

Editor Automotive Industries: Through some misunderstanding we find that the specifications given out covering our 1918 model cars showed the bore and stroke as 3⅛ x 4¼, and the tires 32 x 4. Please take note of this error, the correct engine size being 3 x 4¼ and the tires 33 x 4.—Elgin Motor Car Corp., Chicago.

Detroit-Wyandotte Plant to Be Sold

WYANDOTTE, MICH., Feb. 26—The plant and business of the Detroit-Wyandotte Motor Truck Co., maker of the Horner truck, is being offered for sale by the Security Trust Co., receiver for the organization. The Detroit-Wyandotte company went into receivership in January, with inventoried assets of $200,000 and liabilities of $85,000. The plant covers 2½ acres.

Dodge Brothers Plan Arsenal

DETROIT, Feb 25—Contracts are being let for the erection of a one-story brick and steel arsenal building for Dodge Brothers.

Carde Stamping Starts Production

SAGINAW, MICH., Feb. 25—The Carde Stamping & Tool Co., maker of tools and stamped parts used by the Hupp and Studebaker concerns, has purchased the old Bransfield-Billings plant and is starting operations. The concern is entirely financed by outside capital, but was brought to the city through the efforts of the Board of Trade. Sufficient tool equipment to give employment to 35 toolmakers is already in operation, and it is expected that the stamping department will be ready by May.

Alexander R. Pribl of Detroit is general manager, and associated with him are Clyde P. Crane, Detroit, and C. B. Castle, Cleveland.

Osborn Co. Plans Addition

CLEVELAND, Feb. 26—The Osborn Co., manufacturer of tires and tubes, is planning a factory addition in Garfield, N. J. This will be equipped to turn out 500 tires and 1000 tubes daily.

Maxwell Raises Prices

DETROIT, Feb. 26—The Maxwell Motor Sales Corp. will increase the price of all passenger car models $80 on March 1, and all truck models $100 on March 1. The prices follow:

Model	New Price	Old Price
Passenger Cars		
Touring car	$825	$745
Roadster	825	745
Touring car with winter top.	935	855
Roadster car with winter top.	910	830
Berline (6-passenger town car)	1175	1095
Berline, with wire wheels (optional)	1275	1195
Sedan with wire wheels	1275	1195
Chassis with cowl	735	655
Chassis with commercial delivery body	810	730
Trucks		
1-ton truck chassis	1085	985
1-ton truck chassis with cab and windshield	1125	1025
1-ton truck chassis with stake gate	1180	1080
1-ton truck chassis with combination box stake	1175	1075
1-ton truck chassis with combination box	1135	1035
1-ton truck chassis with canopy body	1195	1095

The prices for Canada and foreign countries will remain the same.

May Revive Racing in United States

CHICAGO, Feb. 24—Motor racing in America for the next year or so may not be taken wholly off the boards if the plans of three different sets of promoters materialize as they expect. When, in response to what is believed to have been government suggestion, the American Automobile Assn. announced last December it would sanction no more races during the war, a decided damper was put on racing as a whole, because the A. A. A. for years has been the official arbiter of organized speed contests. The A. A. A. and those in sympathy with it felt that the need of transportation facilities, fuel, and skilled drivers and mechanics was such that the continuation would be unpatriotic. It was believed that the services of the skilled drivers and mechanics could be better given to the government, either in the aviation or motor transport section.

The stepping aside of the A. A. A. from racing has made it possible for some of the organizations which heretofore have been looked upon as outlaws to have a chance at the A. A. A. stables. Of the organizations which have staged races of more or less local importance without A. A. A. sanction in previous years, two at least and several local promoters have announced plans for a rather ambitious racing season.

The whole situation is rather hazy at the present moment, but if the announcements of the promoters can be believed, and if the government does not put its foot down on racing by prohibiting fuel for transportation, it seems that we will have races at Sheepshead Bay, New York, Providence, Uniontown, and Philadelphia, as well as at the state fairs, promoted by the International Motor Contest Assn.

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Enlist Mechanics in Milwaukee

MILWAUKEE, Feb. 25—The Milwaukee County Council of Defense is endeavoring to supply 1500 machinists and 250 toolmakers for ordnance work at the Rock Island Arsenal, in accordance with the request of Col. George W. Burr. Although many skilled mechanics have already been obtained for government service in this district, the labor situation has not been affected seriously, and the working forces of builders of truck and aviation engines, as well as military trucks, have been kept practically intact.

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Firestone Film to Stop Waste

AKRON, OHIO, Feb. 26—The Firestone Tire & Rubber Co. has produced a propagandist motion picture play entitled "Over the Roads to War." This is intended to show the importance of rubber in the war and to prevent waste. The film shows the simple errors in driving that cause the waste of enough rubber yearly to equip 100,000 fighting motor cars, and has been indorsed by the Government for its contribution to national thrift.

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391 Miles in 60 Hours

LANSING, Feb. 25—A Duplex motor truck completed a run from Lansing to Pittsburgh, a distance of 391 miles, in 60 hr. Fifty-nine gallons of gasoline, 5 qt. of oil and 1 pt. of water were required. The cost of the trip, including everything, was $56.11.

Bids for Mail Airplanes

WASHINGTON, Feb. 22—Three bids have been received to-day for building the five airplanes for the Post Office New York to Washington Aerial Service. These were received from The United Eastern Airplane Co., $59,000, delivery in 30 days; Standard Aero Corp., $68,000, delivery in 63 days; West Virginia Aircraft Co., $72,500, delivery in 90 days.

Second Assistant Postmaster General Otto Praeger yesterday left for a trip through Philadelphia and New York for inspection of landing sites for the airplanes.

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Madison Has Automotive Show

MADISON, WIS., Feb. 23—The sixth annual motor show conducted by dealers and distributers here on Feb. 20, 21 and 22 was one of the most comprehensive displays ever made in Wisconsin, and, for practical purposes, may be characterized as a miniature of the 1918 Minneapolis show because it devoted exceptional attention to trucks, tractors, etc., rather than concentrating on passenger cars.

The show was held in the new warehouse of the Union Transfer & Storage Co. and covered about 45,000 sq. ft. The decorative scheme used by the Milwaukee Automobile Dealers, Inc., at the tenth annual Milwaukee show in the Auditorium, Jan. 17 to 26, was used. The management of the show this year was in the hands of the Automobile Dealers' Division of the Madison Assn. of Commerce, successor to the Madison Automobile Dealers' Assn.

Calendar

ASSOCIATIONS

April 15-19—Little Rock, Ark., United States Good Roads Assn. Sixth Annual Session.

June 5-12—Hot Springs, Va. National Assn. Automobile & Accessory Jobbers.

June 17-19—Dayton, O., Society Automotive Engineers. Annual Midsummer Session.

SHOWS

Feb. 23-Mar. 2—Brooklyn, N. Y., Brooklyn Motor Vehicle Dealers' Assn., 23d Regiment Armory. I. C. Kirkham, Mgr. Passenger cars Feb. 23-Mar. 2; Trucks, Mar. 5-9.

Feb. 23-Mar. 2—Omaha, Neb., Omaha Auto. Trade Assn., Auditorium. Clarke G. Powell, Mgr.

Feb. 25 - Mar. 2—Indianapolis, Indianapolis Automobile Trade Assn., Diamond Chain Work Bldg. John B. Orman, Mgr.

Feb. 25-Mar. 2—Muskegon, Mich. Second Annual, Merrill Auditorium. John C. Fowler, Mgr.

Feb. 27-Mar. 2—Columbus, O., Auto Exhibitors' Co. W. W. Freeman, Mgr.

Feb. 27-Mar. 2 — Burlington, Iowa. Cars, Trucks & Accessories.

Feb. 27-Mar. 6—Boston, Mass., Salon, Boston Automobile Dealers' Assn., Copley Plaza Hotel. Chester I. Campbell, Mgr.

Mar. 1-15—Lyons, France, Third Sample Fair.

Mar. 2-9—Boston, Mass., Boston Auto Dealers' Assn., Mechanics' Bldg. Chester I. Campbell, Mgr.

Mar. 2-9—Pittsburgh, Pa., Automobile Dealers' Assn. of Pittsburgh, Motor Square Garden. John J. Bell, Mgr.

Mar. 4-9—Utica, N. Y., Utica Motor Dealers' Association, Inc., State Armory.

Mar. 6-9—Clinton, Ia., Clinton Automobile Dealers' Assn., Coliseum.

Mar. 6-9—Watertown, N. Y., Automobile Dealers, Inc., State Armory. Arthur E. Sherwood, Mgr.

Mar. 6-9—Mason City, Iowa, Annual Car and Truck. Automobile Dealers' Assn.

Mar. 6-9—St. Joseph, Mo., St. Joseph Automobile Dealers' Assn., Auditorium. John Albus, Mgr.

Mar. 6-9—Sioux Falls, S. D., S. D. Automobile Dealers' Assn.

Mar. 11-16—Cedar Rapids, Ia., Cedar Rapids Auto Trade Assn., Auditorium.

Mar. 12-15—Fargo, N. D., Gate City Auto. Show Co., Auditorium. J. W. Murphy, Mgr.

Mar. 13-16—Raleigh, N. C., Auditorium. John Kelley, Mgr.

Mar. 13-16—Warren, Pa., Warren Automobile Dealers' Assn., Russell Garage.

Mar. 13-16—Peoria, Ill., Peoria Auto. Accessories Dealers' Assn. W. O. Ireland, Mgr.

Mar. 15-20—Great Falls, Mont., Montana Automobile Distributors' Association, Lexington Garage. A. J. Breitenstein, Mgr.

Mar. 19-23—Vancouver, B. C. Western Canada Automobile Show Assn., Horse Show Bldg. D. A. Hamilton, Mgr.

Mar. 20-22—Houlton, Me., Second Annual, Houlton, Motor Car Dealers' Assn., Bangor St. Exhibition Hall. J. D. Luther, Mgr.

Mar. 20-23 — Holdredge, Neb., Second Annual of Southwest Nebraska.

Mar. 20-23 — Trenton, N. J., Trenton Auto Trade Assn., Second Regiment Armory. John L. Brock, Mgr.

Mar. 25-30—Rochester, N. Y., Tenth Annual. Rochester Auto. Trades Assn., Exposition Park. C. A. Simmons, Mgr.

Mar. 25-30 — Bridgeport, Conn., Fourth Regiment Conn. Home Guard State Armory and Casino. B. B. Stelber, Mgr.

Mar. 27-29—Fort Fairfield, Me., Reed's Garage. R. F. Reed, Mgr.

Mar. 30-April 6—Hartford, Conn., Eleventh Annual, Hartford Automobile Dealers' Assn., Inc. State Armory. B. F. Smith, Mgr.

Mar. 30-Apr. 6 — Atlantic City, N. J. Second Annual. Garden Pier. S. W. Megill, Mgr.

Apr. 1-6—York, Pa., York Auto Dealers' Assn. T. F. Felfer, Mgr.

Apr. 6-8 — Green Bay, Wis. Brown County Automobile Trade Assn.

Apr. 6-13 — Red Bank, N. J., Monmouth County Auto. Dealers' Assn., Armory. E. C. Von Kattengell, Mgr.

Apr. 8-13—Reading, Pa. Reading Automobile Trade Assn.

Apr. 9-13—Stockton, Cal., Third Annual San Joaquin Auto Trade Assn. Samuel S. Cohn, Mgr.

Apr. 17-19—Davis, Cal., Tractor Demonstration. University of California.

Apr. 17-20—Calumet, Mich., Upper Peninsular Show, Copper County Automobile Dealers & Garage Owners' Assn., Coliseum.

Sept. 23-28 — Chicago, National Accessory Show for Fords, Coliseum.

ENGINEERING

American Society of Heating and Ventilating Engineers.

Mining and Metallurgical Society of America.